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 and 2004. 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.

REPORTING CLUSTER	NUMBER OF QUESTIONS ON EXAM	NUMBER OF RELEASED TEST QUESTIONS
Logic and Geometric Proofs	23	12
Volume and Area Formulas	11	4
Angle Relationships, Constructions, and Lines	16	8
Trigonometry	15	8
TOTAL	65	32

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 12 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

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

* 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 four 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

Geometry	
GE8.0*	Students know, derive, and solve problems involving perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.
GE9.0	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.
GE10.0*	Students compute areas of polygons, including rectangles, scalene triangles, equilateral triangles, rhombi, parallelograms, and trapezoids.
GE11.0	Students determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures and solids.

* 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 eight 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

Geometry	
GE12.0*	Students find and use measures of sides and of interior and exterior angles of triangles and polygons to classify figures and solve problems.
GE13.0	Students prove relationships between angles in polygons by using properties of complementary, supplementary, vertical, and exterior angles.
GE14.0*	Students prove the Pythagorean theorem.
GE15.0	Students use the Pythagorean theorem to determine distance and find missing lengths of sides of right triangles.
GE16.0*	Students perform basic constructions with a straightedge and compass, such as angle bisectors, perpendicular bisectors, and the line parallel to a given line through a point off the line.
GE17.0*	Students prove theorems by using coordinate geometry, including the midpoint of a line segment, the distance formula, and various forms of equations of lines and circles.

* Denotes key standards

THE TRIGONOMETRY REPORTING CLUSTER

The following five California content standards are included in the Trigonometry reporting cluster and are represented in this booklet by eight 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

Geometry	
GE18.0*	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, $\tan(x) = \sin(x)/\cos(x)$, $(\sin(x))^2 + (\cos(x))^2 = 1$.
GE19.0*	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.
GE20.0	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.
GE21.0*	Students prove and solve problems regarding relationships among chords, secants, tangents, inscribed angles, and inscribed and circumscribed polygons of circles.
GE22.0*	Students know the effect of rigid motions on figures in the coordinate plane and space, including rotations, translations, and reflections.

* Denotes key standards

Geometry

Released Test Questions

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 **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°.

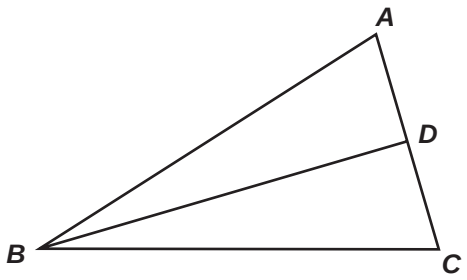
C The largest angle in a triangle is opposite the longest side.

D The sum of the measures of the angles of a triangle is 180°.

3 **Use the proof to answer the question below.**

Given: $\overline{AB} \cong \overline{BC}$; D **is the midpoint of** $\overline{AC}$

Prove: $\triangle ABD \cong \triangle CBD$



	Statement		Reason
1.	$\overline{AB} \cong \overline{BC}$; D is the midpoint of $\overline{AC}$	1.	Given
2.	$\overline{AD} \cong \overline{CD}$	2.	Definition of Midpoint
3.	$\overline{BD} \cong \overline{BD}$	3.	Reflexive Property
4.	$\triangle ABD \cong \triangle CBD$	4.	?

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

A AAS

B ASA

C SAS

D SSS

4 ***"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

---

5 **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

---

6 **Which triangles must be similar?**

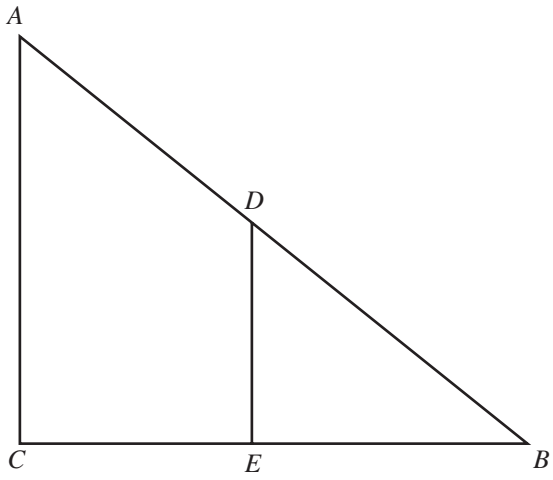
A two obtuse triangles

B two scalene triangles with congruent bases

C two right triangles

D two isosceles triangles with congruent vertex angles

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



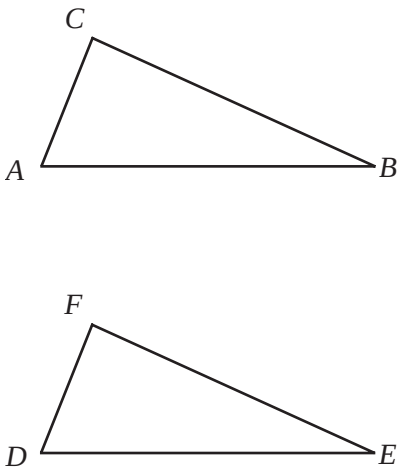
A $\overline{CE}$ and $\overline{BE}$ are congruent.

B $\angle ACE$ is a right angle.

C $\overline{AC}$ and $\overline{DE}$ are parallel.

D $\angle A$ and $\angle B$ are congruent.

8 **In the figure below, $\overline{AC} \cong \overline{DF}$ and $\angle A \cong \angle D$.**



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

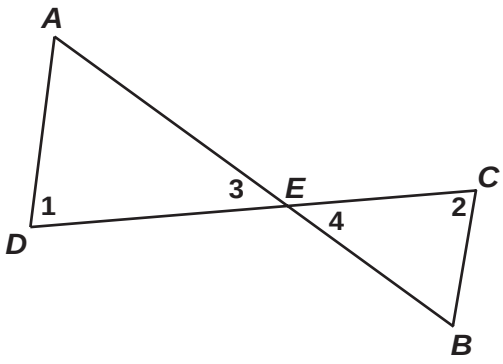
A $\overline{AB} \cong \overline{DE}$

B $\overline{AB} \cong \overline{BC}$

C $\overline{BC} \cong \overline{EF}$

D $\overline{BC} \cong \overline{DE}$

9 **Given: $\overline{AB}$ and $\overline{CD}$ intersect at point E;**
$\angle 1 \cong \angle 2$



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

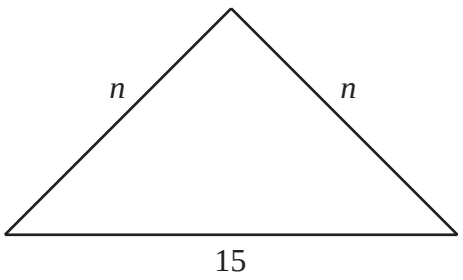
A AA

B SSS

C ASA

D SAS

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



A 1

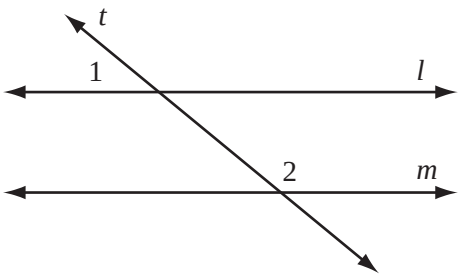
B 7

C 8

D 14

Geometry — Released Test Questions

11 **In the accompanying diagram, parallel lines *l* and *m* are cut by transversal *t*.**



Which statement about angles 1 and 2 *must* be true?

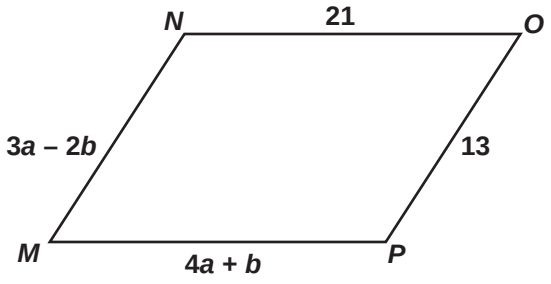
A $\angle 1 \cong \angle 2$.

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.

12 **What values of *a* and *b* make quadrilateral *MNOP* a parallelogram?**



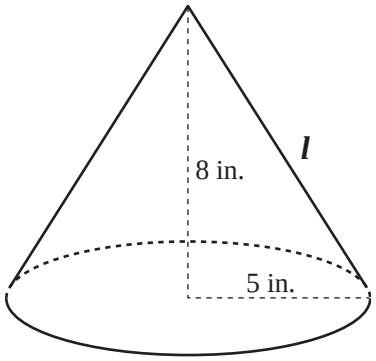
A $a = 1, b = 5$

B $a = 5, b = 1$

C $a = \frac{11}{7}, b = \frac{34}{7}$

D $a = \frac{34}{7}, b = \frac{11}{7}$

13 **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)

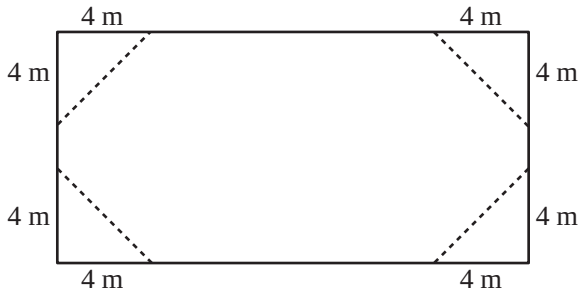
A 40π sq in.

B 445π sq in.

C $5\pi\sqrt{39}$ sq in.

D $5\pi\sqrt{89}$ sq in.

14 **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?

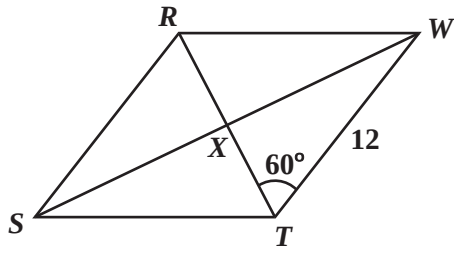
A 136 m^2

B 144 m^2

C 168 m^2

D 184 m^2

15 **If *RSTW* is a rhombus, what is the area of $\triangle WXT$?**



A $18\sqrt{3}$

B $36\sqrt{3}$

C 36

D 48

16 **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

17 **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°

18 **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?**

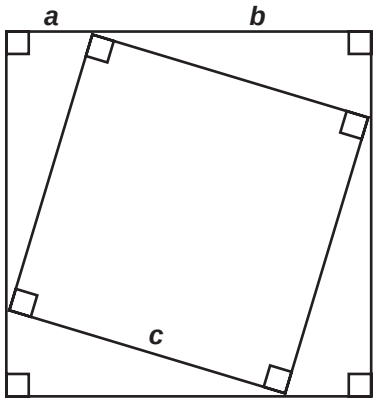
A quadrilateral

B hexagon

C octagon

D decagon

19 **A diagram from a proof of the Pythagorean theorem is pictured below.**



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.

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

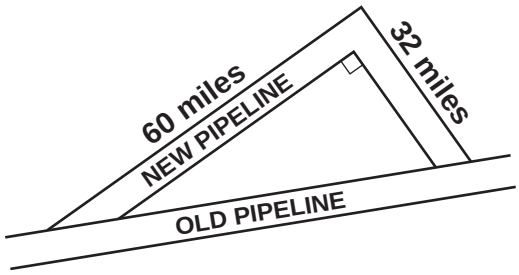
A 3

B $\sqrt{21}$

C $\sqrt{29}$

D 7

21 **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.**



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

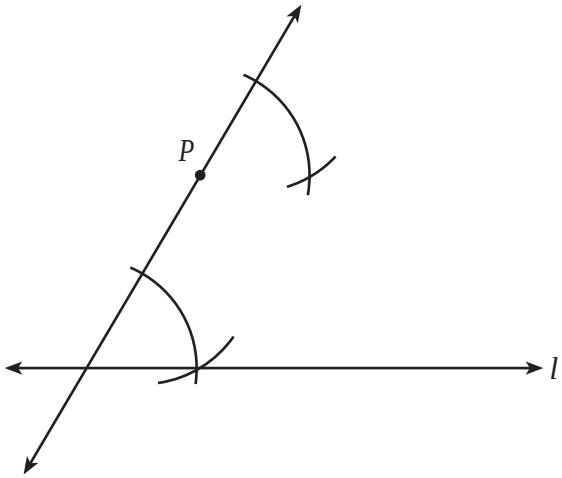
A 24

B 68

C 92

D 160

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



Which *best* describes the construction Marsha is doing?

A a line through *P* parallel to line *l*

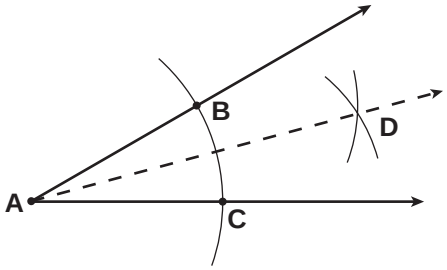
B a line through *P* intersecting line *l*

C a line through *P* congruent to line *l*

D a line through *P* perpendicular to line *l*

23 **Given: angle *A***

What is the first step in constructing the angle bisector of angle *A*?



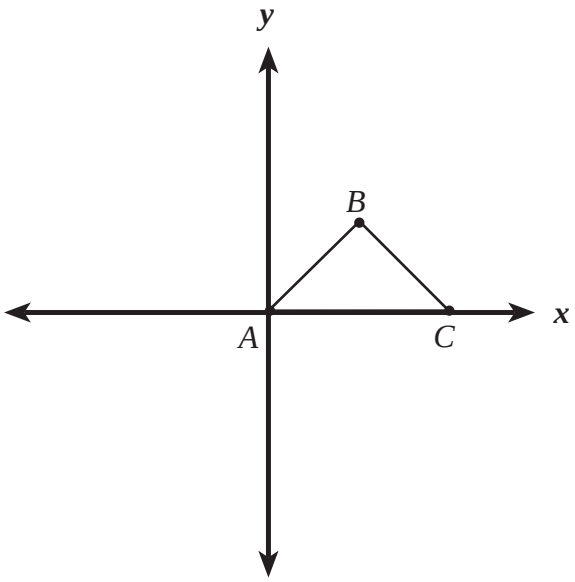
A Draw ray $\overrightarrow{AD}$.

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*.

24 **The diagram shows $\triangle ABC$.**



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

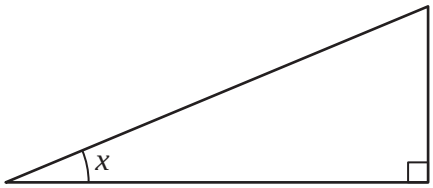
A $\left(\text{slope } \overline{AB}\right)\left(\text{slope } \overline{BC}\right) = 1$

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)

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



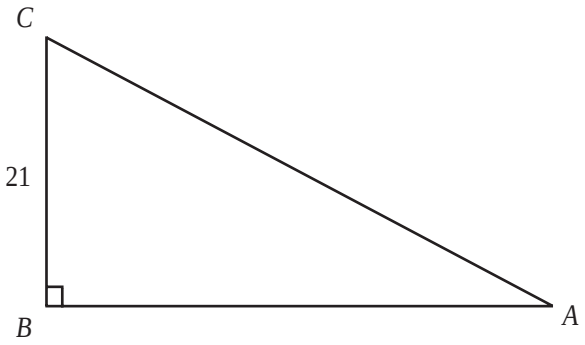
A $\cos x = \frac{12}{13}$ and $\tan x = \frac{5}{12}$

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 $\tan x = \frac{13}{5}$

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



What is the length of $\overline{AC}$?

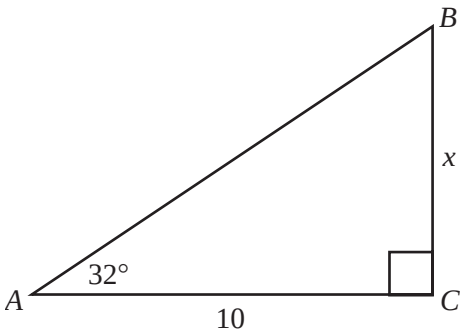
A 14.7

B 21.7

C 30

D 32

27 **In the accompanying diagram, $m\angle A = 32°$ and $AC = 10$. Which equation could be used to find x in $\triangle ABC$?**



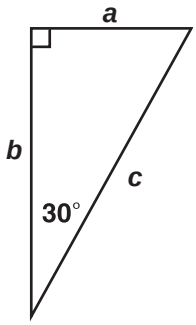
A $x = 10 \sin 32°$

B $x = 10 \cos 32°$

C $x = 10 \tan 32°$

D $x = \dfrac{10}{\cos 32°}$

28 **If $a = 3\sqrt{3}$ in the right triangle below, what is the value of b?**



A 9

B $6\sqrt{3}$

C $12\sqrt{3}$

D 18

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

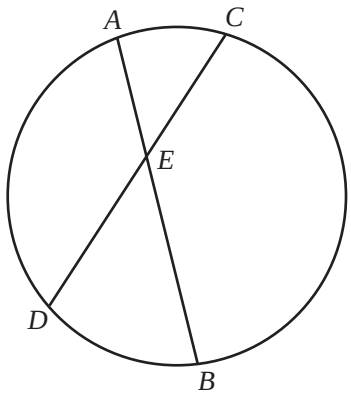
A $\dfrac{1}{4}$

B $\dfrac{1}{2}$

C $\dfrac{2}{\pi}$

D $\dfrac{\pi}{4}$

30 **In the circle below, $\overline{AB}$ and $\overline{CD}$ are chords intersecting at E.**



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

A 7

B 9

C 10

D 13

31 **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 $\triangle DEF$?**

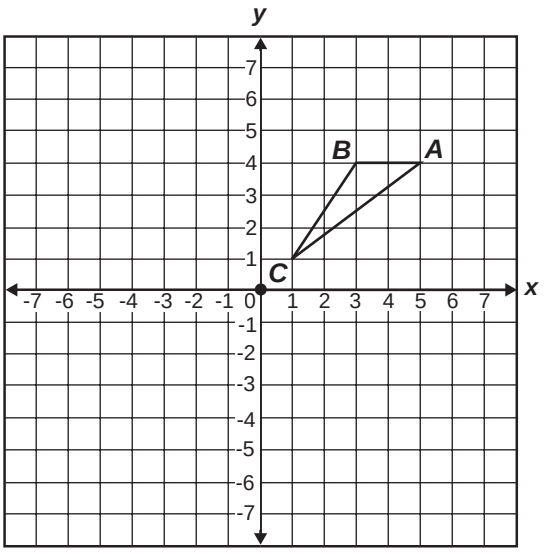
A $D(0, 1), E(1, 2), F(1, 3)$

B $D(0, -1), E(0, 3), F(-2, -2)$

C $D(-2, 2), E(0, 3), F(-1, 0)$

D $D(-1, 0), E(0, 3), F(-2, 2)$

32 **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 $(-4, -5)$

Question Number	Correct Answer	Standard	Year of Test
1	*A*	GE1.0	2004
2	*D*	GE2.0	2003
3	*D*	GE2.0	2004
4	*B*	GE3.0	2003
5	*D*	GE3.0	2004
6	*D*	GE4.0	2003
7	*C*	GE4.0	2004
8	*A*	GE5.0	2003
9	*A*	GE5.0	2004
10	*C*	GE6.0	2003
11	*C*	GE7.0	2003
12	*B*	GE7.0	2004
13	*D*	GE8.0	2003
14	*C*	GE10.0	2003
15	*A*	GE10.0	2004
16	*D*	GE11.0	2004
17	*D*	GE12.0	2003
18	*A*	GE12.0	2003
19	*C*	GE14.0	2004
20	*B*	GE15.0	2003
21	*A*	GE15.0	2004
22	*A*	GE16.0	2003
23	*D*	GE16.0	2004
24	*B*	GE17.0	2004
25	*A*	GE18.0	2003
26	*C*	GE18.0	2004
27	*C*	GE19.0	2003
28	*A*	GE20.0	2004
29	*D*	GE21.0	2003
30	*C*	GE21.0	2004
31	*D*	GE22.0	2003
32	*A*	GE22.0	2004