Question 2 (2017)

Line segment AB has endpoints A (–1.5, 0) and B (4.5, 8). Point C is on line segment AB and is located at (0, 2).

What is the ratio of $\frac{AC}{CB}$?

Question 7 (2017)

A study reports that in 2010 the population of the United States was 308,745,538 people and the land area was approximately 3,531,905 square miles.

Based on the study, what was the population density, in people per square mile, of the United States in 2010? Round your answer to the nearest tenth.

people per square mile

Question 11 (2018)

Jeremy wants to know the density of a rock in grams per cubic centimeter. The rock has a mass of 1.08 kilograms and a volume of 400 cubic centimeters.

What is the density of the rock, in **grams** per cubic centimeter $\left(\frac{g}{cm^3}\right)$?

$\frac{g}{cm^3}$

Definitions

Question 16 2017

Kevin asked Olivia what parallel lines are. Olivia responded, "They are lines that never intersect."

What important piece of information is missing from Olivia's response?

Ⓐ The lines must be straight.

Ⓑ The lines must be coplanar.

Ⓒ The lines can be noncoplanar.

Ⓓ The lines form four right angles.

Question 31 (2018)

Which term is defined as two intersecting lines that form four right angles in a plane?

Ⓐ skew lines

Ⓑ straight lines

Ⓒ parallel lines

Ⓓ perpendicular lines

Slopes

Question 15 (2017)

Square ABCD has vertices at A (1, 2) and B (3, − 3).

What is the slope of $\overline{BC}$?

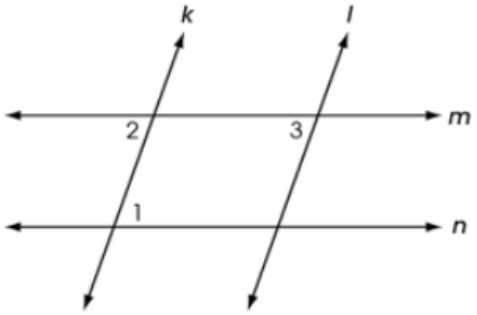
Question 9 (2018)

Line *k* has a slope of −5. Line *j* is perpendicular to line *k* and passes through the point (5, 9).

Create the equation for line *j*.

Question 13 (2017)

Two pairs of parallel lines intersect to form a parallelogram as shown.



Place statements and reasons in the table to complete the proof that the opposite angles of a parallelogram are congruent.

Statements		Reasons	
1.	$m \parallel n$ $k \parallel l$	1.	Given
2.		2.	
3.		3.	
4.		4.	

$\angle 1 \cong \angle 2$

$\angle 1 \cong \angle 3$

$\angle 2 \cong \angle 3$

$\angle 1 \cong \angle 1$

Alternate exterior angles are congruent.

Alternate interior angles are congruent.

Transitive property of congruence

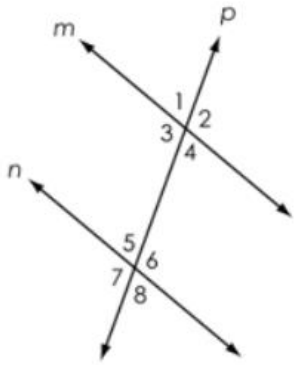
Opposite angles are congruent.

Corresponding angles are congruent.

Question 39 (2018)

Given: $m \parallel n$ and transversal p

Prove: $\angle 5 \cong \angle 4$



Part of a proof is shown. Place statements and reasons in the table to complete the proof.

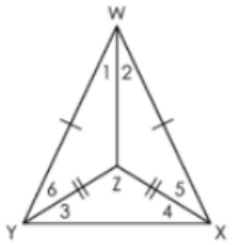
Statements	Reasons
1. $m \parallel n$ and transversal p	1. Given
2.	2.
3.	3.
4. $\angle 5 \cong \angle 4$	4.

$\angle 8 \cong \angle 1$	Vertical angles theorem
$\angle 1 \cong \angle 4$	Corresponding angles postulate
$\angle 8 \cong \angle 4$	Transitive property
$\angle 5 \cong \angle 8$	Alternate exterior angles theorem
$\angle 5 \cong \angle 7$	Reflexive property
$\angle 4 \cong \angle 7$	Angle addition postulate

Proofs

Question 44 (2018)

Triangle YWX is shown.



Given: $\overline{WY} \cong \overline{WX}$, $\overline{ZY} \cong \overline{ZX}$

Prove: $\overline{WZ}$ bisects $\angle YWX$

Place statements and reasons in the blank boxes to complete the proof.

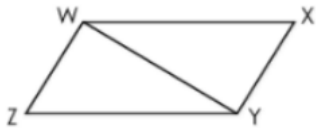
Statements	Reasons
$\overline{WY} \cong \overline{WX}$ $\overline{ZY} \cong \overline{ZX}$	Given
$\angle WYX \cong \angle WXY$ $\angle 3 \cong \angle 4$	
$m\angle WYX = m\angle WXY$ $m\angle 3 = m\angle 4$	Measures of congruent angles are equal.
$m\angle WYX = m\angle 6 + m\angle 3$ $m\angle WXY = m\angle 5 + m\angle 4$	
$m\angle 6 + m\angle 3 = m\angle 5 + m\angle 4$	Substitution
	Substitution
$m\angle 6 = m\angle 5$	
	SAS
$\angle YWZ \cong \angle XWZ$	
$\overline{WZ}$ bisects $\angle YWX$	

$m\angle 6 + m\angle 3 = m\angle 5 + m\angle 3$	$\triangle WYZ \cong \triangle WXZ$	Addition Property of Equality
$m\angle 6 = m\angle 5 + m\angle 4 - m\angle 3$	$\triangle WYX \cong \triangle ZYX$	Substitution
$m\angle 6 + m\angle 3 = m\angle 3 + m\angle 4$	Corresponding parts of congruent triangles are congruent.	Angle Addition Postulate
Base angles of isosceles triangles are congruent.	Definition of angle bisector	Reflexive Property
Corresponding parts of similar triangles are congruent.		

Proofs

Question 21 (2018)

A parallelogram and incomplete proof are shown.



Given: WXYZ is a parallelogram.
Prove: $\overline{WX} \cong \overline{YZ}$

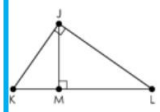
Place reasons in the table to complete the proof.

Statements	Reasons
1. WXYZ is a parallelogram.	1. Given
2. $\overline{WX} \parallel \overline{YZ}$ $\overline{WZ} \parallel \overline{XY}$	2. Definition of a parallelogram
3. $\angle ZWY \cong \angle XYW$ $\angle ZYW \cong \angle XWY$	3.
4. $\overline{WY} \cong \overline{WY}$	4.
5. $\triangle WYZ \cong \triangle YWX$	5.
6. $\overline{WX} \cong \overline{YZ}$	6.

Corresponding angles are congruent.	SSS	Transitive property
Alternate exterior angles are congruent.	SAS	Reflexive property
Alternate interior angles are congruent.	ASA	Angle addition postulate
Corresponding parts of congruent triangles are congruent.	AA	Corresponding parts of congruent triangles are similar.

Proofs

Question 4 (2018)



Mark is proving the Pythagorean Theorem. He draws right triangle JKL with altitude $\overline{JM}$. First he proves $\triangle JKL \sim \triangle MKJ$ and $\triangle JKL \sim \triangle MJL$ using the Angle-Angle criterion. The rest of his proof is shown with some steps missing.

Statements	Reasons
1. $\triangle JKL \sim \triangle MKJ$ and $\triangle JKL \sim \triangle MJL$	1. Angle-Angle criterion
2. $\frac{JK}{LK} = \frac{MK}{JK}$ and $\frac{LJ}{LK} = \frac{ML}{LJ}$	2. Corresponding sides of similar triangles are proportional
3. $(JK)^2 = LK \bullet MK$ and $(LJ)^2 = LK \bullet ML$	3. Multiplication property of equality
4.	4.
5.	5.
6. $MK + ML = LK$	6. Segment addition postulate
7. $(JK)^2 + (LJ)^2 = (LK)^2$	7. Substitution

Which two steps are missing from the proof?

Ⓐ

4. $(JK)^2+(LJ)^2=LK\cdot MK+LK\cdot ML$	4. Addition property of equality
5. $(JK)^2+(LJ)^2=LK(MK+ML)$	5. Distributive property

Ⓑ

4. $(JK)^2+(LJ)^2=LK\cdot MK+LK\cdot ML$	4. Addition property of equality
5. $(JK)^2+(LJ)^2=LK(LK+LK)$	5. Distributive property

Ⓒ

4. $(JK)^2\cdot(JK)^2=LK\cdot MK\cdot LK\cdot ML$	4. Multiplication property of equality
5. $(JK)^2\cdot(LJ)^2=LK(MK\cdot ML)$	5. Distributive property

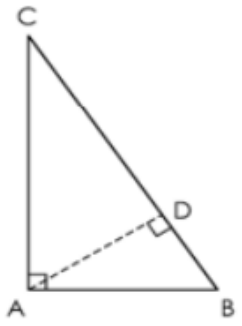
Ⓓ

4. $(JK)^2\cdot(JK)^2=LK\cdot MK\cdot LK\cdot ML$	4. Multiplication property of equality
5. $(JK)^2\cdot(LJ)^2=LK(LK\cdot LK)$	5. Distributive property

Proofs

Question 17 (2017)

James correctly proves the similarity of triangles DAC and DBA as shown.



His incomplete proof is shown.

	Statements		Reasons
1.	$m\angle CAB = m\angle ADB = 90°$	1.	Given
2.	$m\angle ADB + m\angle ADC = 180°$	2.	Angles in a linear pair are supplementary.
3.	$90° + m\angle ADC = 180°$	3.	Substitution
4.	$m\angle ADC = 90°$	4.	Subtraction property of equality
5.	$\angle CAB \cong \angle ADB$ $\angle CAB \cong \angle ADC$	5.	Definition of congruent angles
6.	$\angle ABC \cong \angle DBA$ $\angle DCA \cong \angle ACB$	6.	Reflexive property of congruence
7.	$\triangle ABC \sim \triangle DBA$ $\triangle ABC \sim \triangle DAC$	7.	?
8.	$\triangle DBA \sim \triangle DAC$	8.	Substitution

What is the missing reason for the seventh statement?

Ⓐ CPCTC

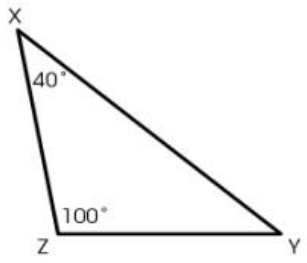
Ⓑ AA postulate

Ⓒ All right triangles are similar.

Ⓓ Transitive property of similarity

Question 3 (2017)

Triangle XYZ is shown.



Which triangle must be similar to triangle XYZ?

Ⓐ a triangle with two angles that measure 40°

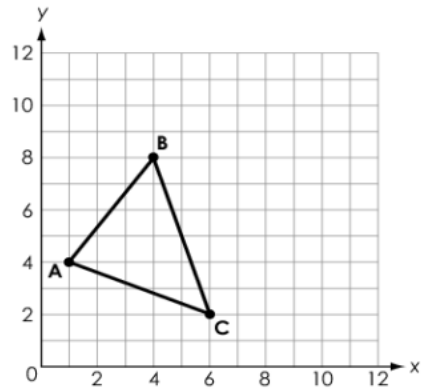
Ⓑ a triangle with angles that measure 40° and 60°

Ⓒ a scalene triangle with only one angle that measures 100°

Ⓓ an isosceles triangle with only one angle that measures 40°

Question 6 (2017)

Triangle ABC is shown.



Triangle A′B′C′ is created by dilating triangle ABC by a scale factor of 4.

What is the length of $\overline{A'B'}$?

Question 8 (2017)

A figure is fully contained in Quadrant II. The figure is transformed as shown.

- a reflection over the x-axis
- a reflection over the line $y = x$
- a 90° counterclockwise rotation about the origin

In which quadrant does the resulting image lie?

Ⓐ Quadrant I

Ⓑ Quadrant II

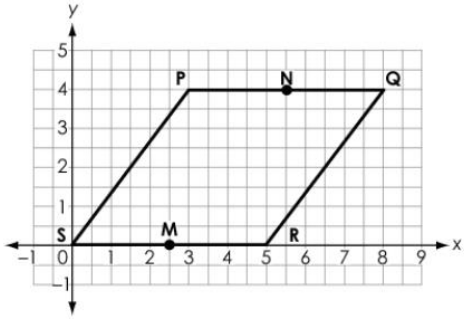
Ⓒ Quadrant III

Ⓓ Quadrant IV

Transformations

Question 12 (2017)

Rhombus PQRS is shown on the coordinate plane. Points M and N are midpoints of their respective sides.



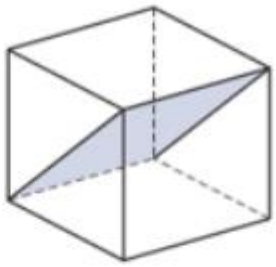
Select all of the transformations that map the rhombus onto itself.

- ☐ a 90° clockwise rotation around the center of the rhombus
- ☐ a 180° clockwise rotation around the center of the rhombus
- ☐ a reflection across $\overline{PR}$
- ☐ a reflection across $\overline{NM}$
- ☐ a reflection across $\overline{QS}$

Transformations

Question 16 (2018)

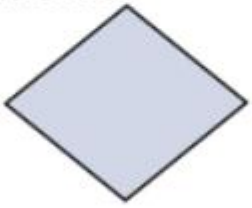
A cube is sliced as shown.



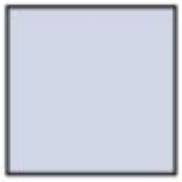
What is the shape of the cross section?

Ⓐ Rectangle

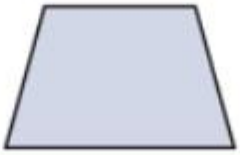
Ⓑ Rhombus



Ⓒ Square



Ⓓ Trapezoid



Transformations

Question 18 (2017)

Triangle ABC is reflected across the line $y = 2x$ to form triangle RST.

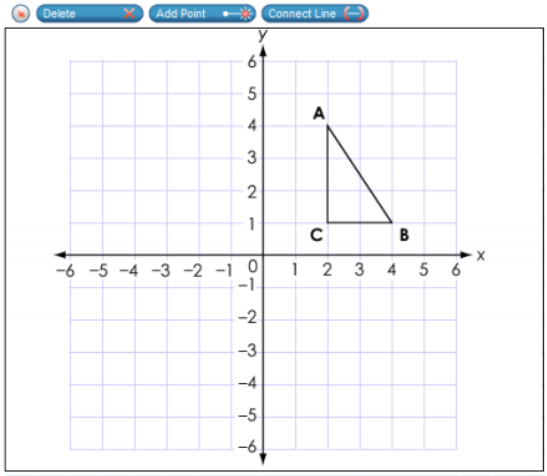
Select all of the true statements.

- ☐ $\overline{AB} = \overline{RS}$
- ☐ $\overline{AB} = 2 \bullet \overline{RS}$
- ☐ $\triangle ABC \sim \triangle RST$
- ☐ $\triangle ABC \cong \triangle RST$
- ☐ $m\angle BAC = m\angle SRT$
- ☐ $m\angle BAC = 2 \bullet m\angle SRT$

Question 20 (2017)

Triangle ABC is reflected across the line $y = x$.

Use the Connect Line tool to create the resulting triangle on the coordinate grid.



Transformations

Question 45 (2018)

The equation of a line is shown.

$6x - 3y = 5$

A dilation centered at the origin with a scale factor of 6 is applied to this line.

A. What is the slope of the line after the dilation?

B. What is the value of the y-intercept of the line after the dilation?

A.

B.

Question 47 (2018)

Triangle MNO is transformed to produce triangle PQR.

Select all of the transformations that would guarantee triangles MNO and PQR are congruent.

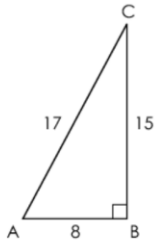
- ☐ a dilation, then a translation
- ☐ a reflection, then a dilation
- ☐ a reflection, then a rotation
- ☐ a rotation, then a translation
- ☐ a translation, then a reflection

Name_____

Trig

Question 8 (2018)

A right triangle ABC is shown.



What is cos A?

Question 14 (2017)

Angle A is the complement of angle B.

Which equation about the two angles must be true?

Ⓐ sin A = sin B

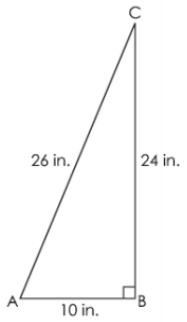
Ⓑ sin A = cos A

Ⓒ cos B = sin B

Ⓓ cos A = sin B

Question 21 (2017)

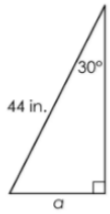
Triangle ABC is shown.



What is tan(A)?

Question 23 (2018)

A triangle is shown.



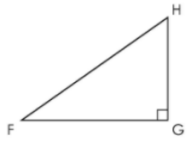
What is the length, in inches (in.), of side *a*?

in.

1 2 3
4 5 6
7 8 9
0
. - ⅟

Question 40 (2018)

Right triangle FHG is shown.



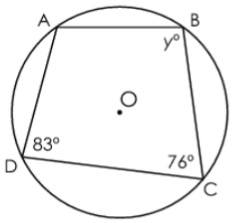
The sine of ∠F is 0.53.

What is the cosine of ∠H? Round your answer to the nearest hundredth as needed.

Name_____

Question 10 (2017)

Quadrilateral ABCD is inscribed in circle O, as shown.



What is the value of y?

$y =$

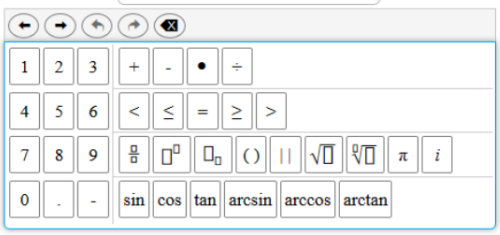
Question 19 (2017)

The equation of a circle is shown.

$x^2 + y^2 - 10x + 8y + 16 = 0$

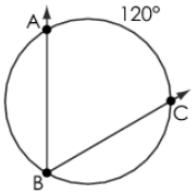
What is the radius of the circle?

radius:



Question 19 (2018)

Angle ABC is inscribed in a circle as shown.



What is the measure, in degrees, of ∠ABC?

degrees

Question 29 (2018)

Points A, B and C lie on a circle with center Q.

- The area of sector AQB is twice the area of sector BQC.
- The length of arc AB is 28 centimeters.

What is the length, in centimeters, of arc BC?

centimeters

Probability

Question 4 2017

During a 90-day semester, a student records whether he arrives at school on time and whether he goes to bed by 10:00 p.m. the night before. The results are shown in the table.

Number of Occurrences

	Arrives at School on Time	Arrives at School Late
Goes to Bed by 10:00 p.m.	72	8
Goes to Bed After 10:00 p.m.	9	1

Does the student arriving at school on time depend on whether the student goes to bed by 10:00 p.m.? Justify your reasoning.

Type your answer in the space provided.

Question 9 (2017)

An online retailer conducts a random survey of its customers. The survey shows that 80% of the customers receive their purchases within four days, and 95% of those customers are satisfied with the quality of their purchases.

What percent of all customers receive their purchases within four days and are not satisfied with the quality of their purchases?

(A) 4%

(B) 5%

(C) 19%

(D) 24%

Question 11 (2017)

Josh has a bag containing pieces of candy. The bag contains 10 red circular pieces, 10 red square pieces, 10 blue triangular pieces, and 10 blue star-shaped pieces. He draws a red piece of candy from the bag.

What is the complement of this event?

(A) He draws a blue piece.

(B) He draws a square piece.

(C) He draws a circular piece.

(D) He draws a star-shaped piece.

Probability

Question 12 (2018)

The two-way table shows the number of births, in thousands, in the United States for the years 2010 and 2011.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
2010	324	303	340	327	325	338	346	359	350	342	337	326	4017
2011	322	299	330	315	328	335	348	362	346	331	328	322	3966

A baby born in 2011 is randomly selected.

What is the probability that the baby was born in February?

Question 15 (2018)

A total of 50 students play either soccer or lacrosse.

- 20 girls play lacrosse.
- 20 boys play either soccer or lacrosse.
- 20 students play soccer.

What is the probability that a student plays soccer or is a girl?

Question 18 (2018)

Events A and B are independent.

P(A and B) = 0.25

Enter possible probabilities for events A and B.

$P(A) =$

$P(B) =$

Probability

Question 48 (2018)

Rosa collects data on what students at her school like to eat at the movie theater. She asks a random sample of 120 students two questions:

- Do you like to eat popcorn at the movie theater?
- Do you like to eat candy at the movie theater?

Her data are partially shown in the table. Of the students she asks, 60% of those who like to eat popcorn also like to eat candy.

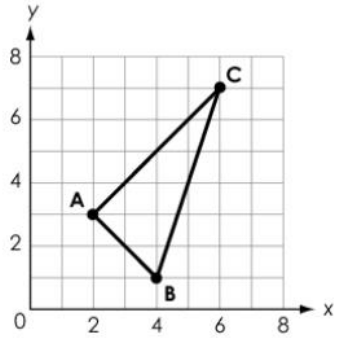
Complete the table to show the number of students in each category.

	Like Popcorn	Don't Like Popcorn	Total
Like Candy			
Don't Like Candy			62
Total	70		120

Volume and Area

Question 1 (2017)

Triangle ABC is shown.



Which three-dimensional figure results from rotating the triangle 360° about $\overline{AC}$?

Ⓐ cone

Ⓑ cylinder

Ⓒ pyramid

Ⓓ sphere

Question 5 (2017)

A globe has a diameter of 12 inches. It fits inside a cube-shaped box that has a side length of 12 inches.

What is the volume, rounded to the nearest hundredth of a cubic inch, of the space inside the box that is not taken up by the globe?

cubic inches

Question 34 (2018)

A cone and a sphere have the same volume. The height of the cone is 96 units.

What could be the values for the radius of the cone and the sphere? Round your answers to the nearest hundredth as needed.

Radius of Cone: *units*

Radius of Sphere: *units*