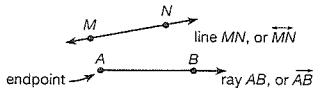
SKILL 1:
Lines and Angles

Student pages 1–2

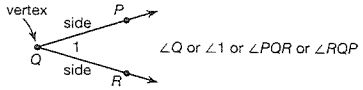
Name _____ Date _____ Class _____

SKILL 1: Lines and Angles

A **line** is straight and extends without end in two directions. A **ray** is straight but extends without end in only one direction. The point where a ray starts is its **endpoint**.

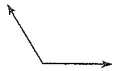


Two rays with the same endpoint form an **angle**. The rays are the **sides** of the angle. The shared endpoint is the **vertex** of the angle.



An acute angle has a measure less than 90°.

A right angle has a measure of exactly 90°.

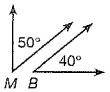


An obtuse angle has a measure greater than 90° and less than 180°.

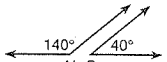
A straight angle has a measure of exactly 180°.

Two angles are **complementary** if the sum of their measures is 90°

Two angles are **supplementary** if the sum of their measures is 180°



50° + 40° = 90°
∠M is the complement of ∠B.



140° + 40° = 180°
∠N is the supplement of ∠B.

Example

Find the measures of the complement and the supplement of ∠N.

A complement of ∠N measures 90° − 54° = 36°.

A supplement of ∠N measures 180° − 54° = 126°.

Guided Practice

1. What is the vertex of the angle at the right? F

2. What are two names for the angle at the right?
Possible answers: ∠F, ∠EFG, or ∠GFE

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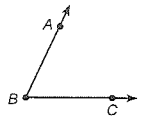
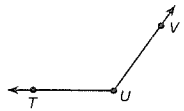
SKILL 1: Practice

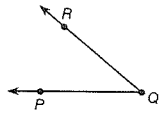
Name each angle.



1. ∠ABC, ∠CBA, or ∠B



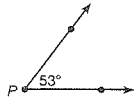
2. ∠TUV, ∠VUT, or ∠U



3. ∠PQR, ∠RQP, or ∠Q

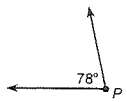
Find the measure of the complement and the measure of the supplement of ∠P.

4.



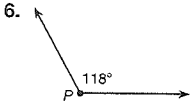
complement: 37°
supplement: 127°

5.



complement: 12°
supplement: 102°

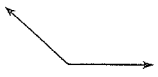
6.



complement: none
supplement: 62°

Tell whether each angle appears to be acute, obtuse, right, or straight.

7.

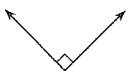


obtuse

8.

acute

9.

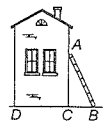


right

10.

straight

11. A ladder is leaning against the wall of a building.



a. What kind of angle is formed by the ground and the wall? right

b. What angle is the supplement of ∠ACB? ∠ACD

TEST PREP

12. What kind of angle has a measure of 130°?

Skill 1

A acute
C right
(B) obtuse
D straight

13. What is the measure of the supplement of a 70° angle?

Skill 1

F 20°
(H) 110°
G 90°
J 120°

SKILL 2:
Parallel and Perpendicular Lines

Student pages 3–

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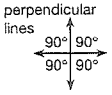
SKILL 2: Parallel and Perpendicular Lines

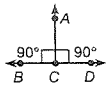
Two lines in the same plane that never cross are **parallel** lines.

Two lines that cross are **intersecting** lines.



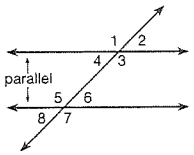
Two intersecting lines that form four right angles are **perpendicular** lines.

Remember that the measure of a right angle is 90°. In symbols, $m\angle ACD = 90°$ and $m\angle ACB = 90°$. Angles that have the same measure are **congruent**. We write $\angle ACD \cong \angle ACB$.



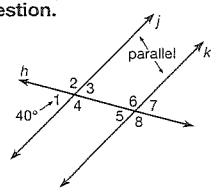
When two parallel lines are intersected by a third line, pairs of congruent angles are formed. Here are some pairs of congruent angles.

Alternate Interior Angles	$\angle 3 \cong \angle 5$, $\angle 4 \cong \angle 6$
Corresponding Angles	$\angle 1 \cong \angle 5$, $\angle 2 \cong \angle 6$, $\angle 3 \cong \angle 7$, $\angle 4 \cong \angle 8$
Vertical Angles	$\angle 1 \cong \angle 3$, $\angle 2 \cong \angle 4$, $\angle 5 \cong \angle 7$, $\angle 6 \cong \angle 8$



Example

Lines *j* and *k* are parallel, and m∠1 = 40°. Answer each question.

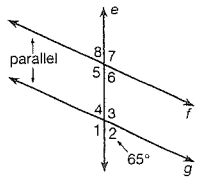


a. Name the other angles that have a measure of 40°.
∠3, ∠5, and ∠7 have the same measure as ∠1.
So ∠3, ∠5, and ∠7 have a measure of 40°.

b. Find the measure of ∠6. ∠6 and ∠5 are supplementary. From part **a** you know that $m\angle 5 = 40°$. $m\angle 6 + 40° = 180°$. So, $m\angle 6 = 180° - 40°$ and $m\angle 6 = 140°$.

Guided Practice

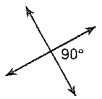
1. Name the two parallel lines. *f and g*
2. If $m\angle 2 = 65°$, then $m\angle 8 =$ *65°*.
3. If $m\angle 2 = 65°$, then $m\angle 7 =$ *115°*.



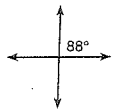
Name _____ Date _____ Class _____

SKILL 2: Practice

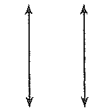
Indicate if each pair of lines appears to be parallel, perpendicular, or neither. Each pair of lines is in the same plane.

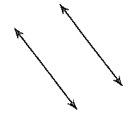
1. 

perpendicular

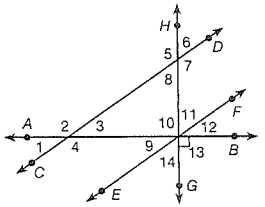
2. 

neither

3. 
parallel

4. 
parallel

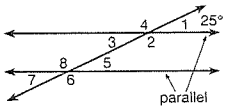
Use the figure to name each pair of lines or angles.



5. a pair of parallel lines *$\overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$*
6. a pair of perpendicular lines *$\overleftrightarrow{AB}$ and $\overleftrightarrow{GH}$*
7. a pair of supplementary angles *∠5 and ∠6*
8. a pair of congruent angles *∠10 and ∠13*
9. a pair of complementary angles *∠11 and ∠12*

Answers to Exercises 7–9 may vary.

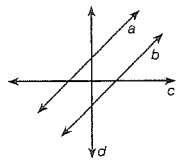
10. In the figure, a line intersects two parallel lines. One angle measure is given. Find each of the other angle measures.



$m\angle 1 = 25°$
$m\angle 2 =$ *155°*
$m\angle 3 =$ *25°*
$m\angle 4 =$ *155°*
$m\angle 5 =$ *25°*
$m\angle 6 =$ *155°*
$m\angle 7 =$ *25°*
$m\angle 8 =$ *155°*

TEST PREP

11. Which lines appear to be perpendicular? *Skill 2*



A *a* and *b*
B *b* and *c*
C *c* and *d*
D *b* and *d*

12. What is the measure of the complement of a 72° angle? *Skill 1*

F 18°
G 28°
H 108°
J 118°

SKILL 3:
Midpoints and Bisectors

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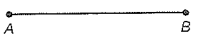
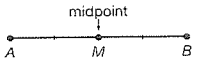
SKILL 3: Midpoints and Bisectors

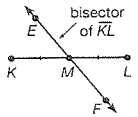
A **line segment** is formed by two endpoints and all the points between them.



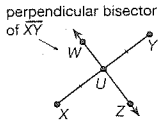
The **midpoint** of a segment divides it into two **congruent** segments. Congruent segments have equal lengths. M is the midpoint of $\overline{AB}$. $\overline{AM} \cong \overline{MB}$



$\overline{EF}$ is the **bisector** of $\overline{KL}$. The two marks on $\overline{KL}$ show equal parts. $\overline{KM} \cong \overline{ML}$

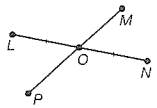


The midpoint of $\overline{XY}$ is U, and $\overline{WZ}$ is perpendicular to $\overline{XY}$ at U. So $\overline{WZ}$ is the **perpendicular bisector** of $\overline{XY}$.



Example

Use the figure to name a line segment, two congruent segments, a midpoint, and a bisector.

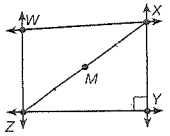


The two endpoints L and N form the line segment $\overline{LN}$. The tick marks show that $\overline{LO} \cong \overline{ON}$. So, O is the midpoint of $\overline{LN}$. $\overline{MP}$ is a bisector of $\overline{LN}$.

Guided Practice

Use the figure to name each of the following. Possible answers given.

1. a line segment $\overline{XZ}$, $\overline{WZ}$, $\overline{WX}$, $\overline{XY}$, $\overline{YZ}$, $\overline{ZM}$, or $\overline{MX}$
2. a midpoint M
3. two congruent segments $\overline{ZM}$ and $\overline{MX}$



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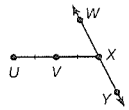
SKILL 3: Practice

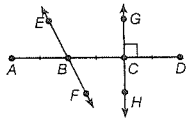
Use the figure to name each of the following: Possible answers are given.

1. a midpoint V
2. a line segment $\overline{UV}$, $\overline{VX}$, $\overline{UX}$, $\overline{WX}$, $\overline{XY}$ or $\overline{WY}$
3. a pair of congruent segments $\overline{UV}$ and $\overline{VX}$
4. a bisector none



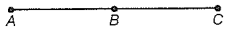
Use the figure to name each of the following:

5. a bisector that is not perpendicular $\overleftrightarrow{EF}$
6. a perpendicular bisector $\overleftrightarrow{GH}$
7. a pair of congruent segments $\overline{AB}$ and $\overline{BC}$ or $\overline{BC}$ and $\overline{CD}$ or $\overline{AB}$ and $\overline{CD}$
8. a midpoint B or C



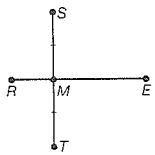
B is the midpoint of $\overline{AC}$. Tell whether each statement is *true* or *false*.

9. $\overline{AB} \cong \overline{BC}$ true
10. $\overline{AC}$ is a bisector. false
11. If $\overline{BC}$ measures 4 cm, the measure of $\overline{AB}$ is 4 cm. true



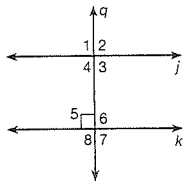
TEST PREP

12. Point M is the midpoint of which segment? *Skill 3*



A $\overline{RM}$ C $\overline{RE}$
B $\overline{SM}$ (D) $\overline{ST}$

13. Lines j and k are parallel, and line q is perpendicular to line k. What is the measure of $\angle 3$? *Skill 2*



(F) 90° H 270°
G 180° J 360°

SKILL 4: Polygons

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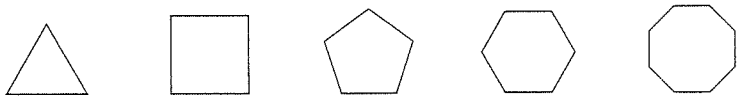
SKILL 4: Polygons

A **polygon** is a closed figure with three or more straight sides. A polygon is classified by the number of sides it has. In a **regular** polygon, all the sides have the same length, and all the angles have the same measure.

3 sides **triangle** | 4 sides **quadrilateral** | 5 sides **pentagon** | 6 sides **hexagon** | 8 sides **octagon**



regular triangle | **regular quadrilateral** | **regular pentagon** | **regular hexagon** | **regular octagon**

Example

Classify the polygon and tell if it is regular.

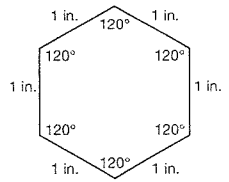
Count the sides. There are six sides, so the polygon is a hexagon.

Are the sides congruent? Yes. They all measure 1 inch.

Are the angles congruent? Yes. They are all 120°.

All sides and all angles are congruent, so the hexagon is regular.

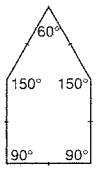
The polygon is a regular hexagon.



Guided Practice

Classify the polygon and tell if it is regular.

1. How many sides does the polygon have? 5
2. Name the type of polygon. pentagon
3. Are the sides congruent? yes
4. Are the angles congruent? no
5. Is the polygon regular? no



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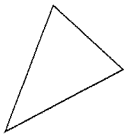
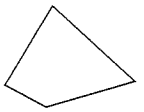
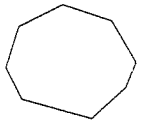
SKILL 4: Practice

Classify each polygon by the number of sides it has.

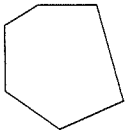
1.  triangle

2.  pentagon

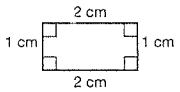
3.  quadrilateral

4.  octagon

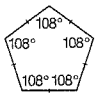
5.  quadrilateral

6.  hexagon

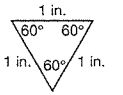
Tell whether each polygon is regular.

7. 

no

8. 

yes

9. 

yes

10. Jill cut a corner off a sheet of notebook paper. The larger of the two pieces was a pentagon. What kind of polygon was the corner piece? triangle

TEST PREP

11. What kind of polygon has 6 sides? *Skill 4*

(A) hexagon C octagon
B pentagon D quadrilateral

12. What is the measure of the complement of a 54° angle? *Skill 1*

F 26° H 116°
(G) 36° J 126°

SKILL 5: PROBLEM SOLVING: Find a Pattern

Name _____ Date _____ Class _____

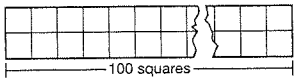
SKILL 5: PROBLEM SOLVING: Find a Pattern

Finding a pattern is a useful strategy for solving many problems in geometry.

Example

How many 2 x 2 squares can be drawn in a strip of squares 2 squares tall and 100 squares long?

Read The strip of squares is 2 squares tall and 100 squares long.



Plan Make a table showing how many 2 × 2 squares are in strips 2 squares long, 3 squares long, 4 squares long, and so on. Note: squares may overlap on the strip.

Length of strip	2	3	4	5
Number of 2 x 2 squares	1	2	3	4

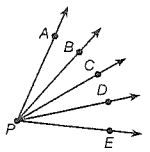
Solve Look for a pattern. Notice that each number in the second row is one less than the number above it. In a strip 2 squares tall and 100 squares long, there will be 100 − 1 or 99 of the 2 × 2 squares.

Look Back If you take the first 2 × 2 square on the left, you can move it to the right 1 small square at a time. You can do this 98 times to get the rest of the 2 × 2 squares in the strip. In all, you will have 99 of the 2 × 2 squares.

Guided Practice

Find how many angles are in the figure.

1. How many angles have $\overrightarrow{PA}$ as a side? 4
2. How many angles *not already counted* have $\overrightarrow{PB}$ as a side? 3
3. How many angles *not already counted* have $\overrightarrow{PC}$ as a side? 2
4. How many angles *not already counted* have $\overrightarrow{PD}$ as a side? 1



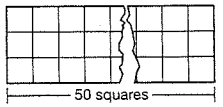
5. Total number of angles: 4 + 3 + 2 + 1 = 10 angles

Name _____ Date _____ Class _____

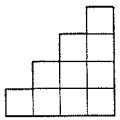
SKILL 5: Practice

Use patterns to solve each problem.

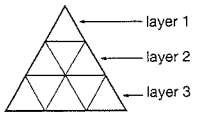
1. How many 2 x 2 squares are in a strip of squares that is 3 squares tall and 50 squares long? 98



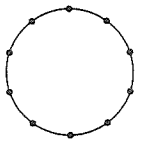
2. How many 3 x 3 squares are in a strip of squares that is 3 squares tall and 50 squares long? 48
3. How many squares are there in a strip of squares 4 squares tall and 20 squares long? (Hint: Find the number of 1 x 1 squares, 2 x 2 squares, 3 x 3 squares, and 4 x 4 squares.) 190
4. Yolanda is making staircase shapes by using square tiles, as shown in the diagram at the right. How many tiles will she need to make a staircase that is 10 tiles tall? 55



5. Lee is going to make a shape like the one shown at the right. He has exactly enough tiles for a shape with 20 layers. How many tiles does he have? 400



6. Suppose you mark 10 points on a line. How many line segments have two of these points as endpoints? 45
7. Suppose you mark 10 points on a circle. How many triangles are possible that have 3 of these points as corner points? 120

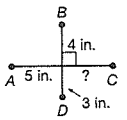


TEST PREP

8. How many angles are formed by 7 rays that have a common endpoint? *Skill 5*

A 13 C 21
B 15 D 35

9. $\overline{BD}$ is the perpendicular bisector of $\overline{AC}$. What is the measure of $\overline{AC}$? *Skill 3*



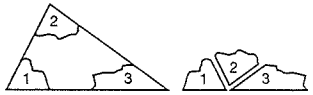
F 10 in.
G 5 in.
H 4 in.
J 3 in.

SKILL 6: Triangles

Name _____ Date _____ Class _____

SKILL 6: Triangles

You can tear the corners from a triangle and rearrange them as shown in the diagram. Notice the torn-off pieces form a straight line across the bottom. The measures of these three angles total 180°, the measure of a straight angle. This illustrates an important property of triangles:



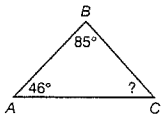
$m\angle 1 + m\angle 2 + m\angle 3 = 180°$

The sum of the angle measures of any triangle is 180°.
You can use this fact to find unknown angle measures.

Example 1

Find the measure of $\angle C$.

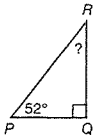
$46° + 85° + m\angle C = 180°$
$131° + m\angle C = 180°$
$m\angle C = 180° - 131°$ Subtract 131°
$m\angle C = 49°$ from each side.



Example 2

Find the measure of $\angle R$.

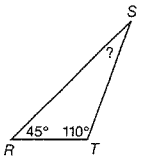
$\angle Q$ is a right angle, so $m\angle Q = 90°$.
$52° + 90° + m\angle R = 180°$
$142° + m\angle R = 180°$
$m\angle R = 180° - 142°$ Subtract 142°
$m\angle R = 38°$ from each side.



Guided Practice

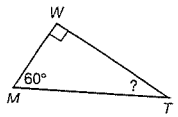
Find the unknown angle measures.

1.



$m\angle S + 45° + \underline{110°} = 180°$
$m\angle S + 155° = 180°$
$m\angle S = 180° - 155°$
$m\angle S = \underline{25°}$

2.



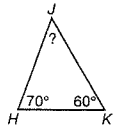
$60° + 90° + m\angle T = 180°$
$150° + m\angle T = \underline{180°}$
$m\angle T = 180° - 150°$
$m\angle T = \underline{30°}$

Name _____ Date _____ Class _____

SKILL 6: Practice

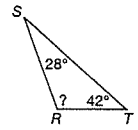
Find the unknown angle measures.

1.



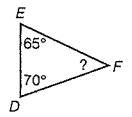
$m\angle J = \underline{50°}$

2.



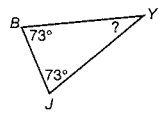
$m\angle R = \underline{110°}$

3.



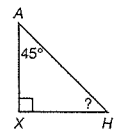
$m\angle F = \underline{45°}$

4.



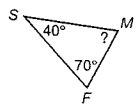
$m\angle Y = \underline{34°}$

5.



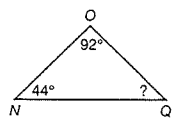
$m\angle H = \underline{45°}$

6.



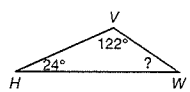
$m\angle M = \underline{70°}$

7.



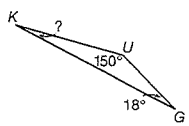
$m\angle Q = \underline{44°}$

8.



$m\angle W = \underline{34°}$

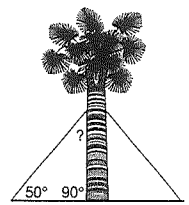
9.



$m\angle K = \underline{12°}$

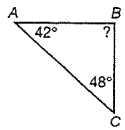
10. Wires are used to support a young tree, as shown. One of the wires makes a 50° angle with the ground. What is the measure of the angle the wire makes with the tree?

$\underline{40°}$



TEST PREP

11. Find the measure of $\angle B$. *Skill 6*



A 132° C 100°
B 80° (D) 90°

12. An angle is formed by rays $\overrightarrow{AB}$ and $\overrightarrow{AC}$. Which is not a name for this angle? *Skill 1*

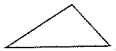
(F) $\angle ABC$ H $\angle CAB$
G $\angle BAC$ J $\angle A$

SKILL 7: Classifying Triangles

Name _____ Date _____ Class _____

SKILL 7: Classifying Triangles

Line segments are **congruent** if they have the same length. One way to classify triangles is by the number of congruent sides they have.



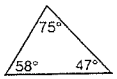
scalene triangle
no congruent sides

isosceles triangle
two or more congruent sides

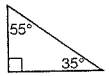
equilateral triangle
three congruent sides

Notice that since an equilateral triangle has two or more congruent sides, it is also an isosceles triangle.

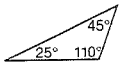
Another way to classify triangles is by their angles.



acute triangle
three acute angles



right triangle
one right angle

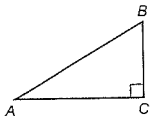


obtuse triangle
one obtuse angle

Example

Classify the triangle by its sides and its angles.

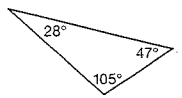
No two sides of the triangle are congruent, so triangle *ABC* is scalene. The triangle has a right angle. Triangle *ABC* is also a right triangle.



Guided Practice

Classify the triangle by its sides and angles.

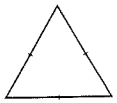
1. Are any of its sides congruent? no
2. What name is given to a triangle with that number of congruent sides? scalene
3. Is there a right or an obtuse angle, or are all angles acute? an obtuse angle
4. The triangle is scalene and obtuse.



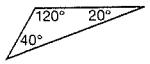
Name _____ Date _____ Class _____

SKILL 7: Practice

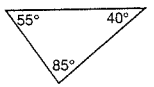
Classify each triangle by its sides.

1.  scalene
2.  equilateral (also isosceles)
3.  isosceles

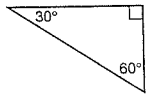
Classify each triangle by its angles.

4. 

obtuse

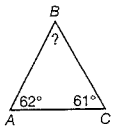
5. 

acute

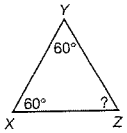
6. 

right

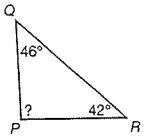
Recall that the sum of the angle measures of any triangle is 180°. Use this fact to find the missing angle measure. Then classify the triangle by its angles.

7. 

$m\angle B =$ 57°
acute

8. 

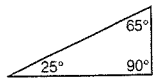
$m\angle Z =$ 60°
acute

9. 

$m\angle P =$ 92°
obtuse

TEST PREP

10. Which is a correct description of the triangle? *Skill 7*



A obtuse
B equilateral
C scalene
D isosceles

11. What kind of polygon has exactly 4 sides? *Skill 4*

F triangle
G quadrilateral
H octagon
J hexagon

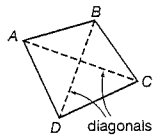
SKILL 8:
Diagonals and Angles of Quadrilaterals

Student pages 17–18

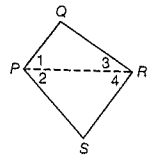
Name _____ Date _____ Class _____

SKILL 8: Diagonals and Angles of Quadrilaterals

A corner point of a quadrilateral is called a **vertex** of the quadrilateral. A segment that joins two opposite **vertices** (plural of vertex) is called a **diagonal**. The diagonals of quadrilateral *ABCD* are $\overline{AC}$ and $\overline{BD}$.



The sum of the four angle measures of a quadrilateral is always 360°. To see why, look at quadrilateral *PQRS*. The diagonal $\overline{PR}$ divides *PQRS* into two triangles. The sum of the angle measures of each triangle is 180°. From this you can see that the sum of the angle measures of *PQRS* is 180° + 180°, or 360°.



The sum of the angle measures of any quadrilateral is 360°.

Example

Find the measure of ∠*Y* in quadrilateral *WXYZ*.

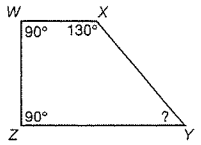
The sum of the angle measures of the quadrilateral is 360°.

$90° + 90° + 130° + m\angle Y = 360°$

$310° + m\angle Y = 360°$

To find the measure of ∠*Y*, subtract 310° from each side.

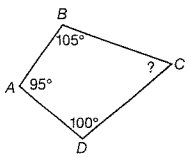
So $m\angle Y = 360° - 310°$, which tells you that $m\angle Y = 50°$.



Guided Practice

Find the missing angle measures.

1.

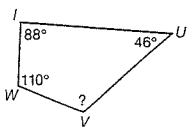


$105° + 95° + 100° + m\angle C = 360°$

$\underline{300°} + m\angle C = 360°$

$m\angle C = \underline{60°}$

2.



$110° + \underline{88°} + 46° + m\angle V = 360°$

$\underline{244°} + m\angle V = 360°$

$m\angle V = \underline{116°}$

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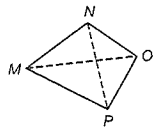
SKILL 8: Practice

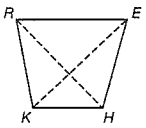
Name the diagonals of each quadrilateral.

1.



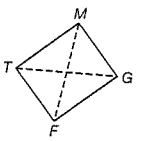
$\overline{MO}$ and $\overline{NP}$

2.



$\overline{RH}$ and $\overline{KE}$

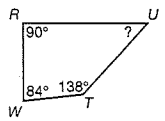
3.



$\overline{TG}$ and $\overline{FM}$

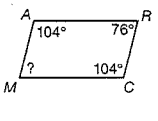
Find the missing angle measures.

4.



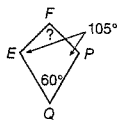
$m\angle U = \underline{48°}$

5.



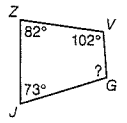
$m\angle M = \underline{76°}$

6.



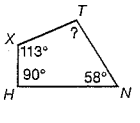
$m\angle F = \underline{90°}$

7.



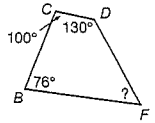
$m\angle G = \underline{103°}$

8.



$m\angle T = \underline{99°}$

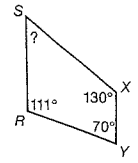
9.



$m\angle F = \underline{54°}$

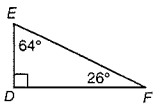
TEST PREP

10. What is the measure of ∠*S*? *Skill 8*



A 38°
B 49°
C 59°
D 69°

11. What kind of triangle is triangle *DEF*? *Skill 7*



F acute
G isosceles
H obtuse
J right

SKILL 9: Classifying Quadrilaterals

Student pages 19–20

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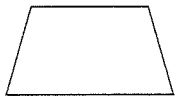
SKILL 9: Classifying Quadrilaterals

Some quadrilaterals have special names.

trapezoid

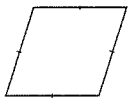


exactly one pair of parallel sides

parallelogram

two pairs of parallel sides

rhombus

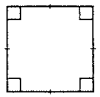


parallelogram with all sides the same length

rectangle

parallelogram with four right angles

square



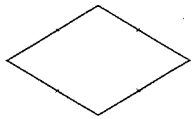
rectangle with all sides the same length

Example

Give all the special names that apply to the quadrilateral.

Two pairs of sides are parallel. Since two pairs of sides of the quadrilateral are parallel, it is a parallelogram.

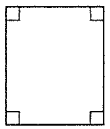
All sides have the same length, so the quadrilateral is also a rhombus.



Guided Practice

Give all the special names that apply to the quadrilateral.

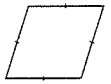
1. Does the quadrilateral have any parallel sides? yes
2. If so, how many pairs? 2
3. What name is given to a quadrilateral with that many pairs of parallel sides? parallelogram
4. Are all sides the same length? no
5. How many right angles are there? 4
6. What is another name for the quadrilateral? rectangle



Name _____ Date _____ Class _____

SKILL 9: Practice

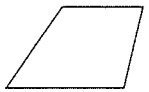
Classify each quadrilateral. Give all the special names that apply.

1. 

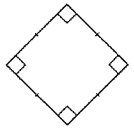
rhombus
parallelogram

2. 

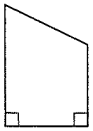
rectangle
parallelogram

3. 

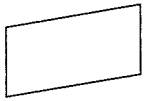
trapezoid

4. 

square, rhombus, rectangle, parallelogram

5. 

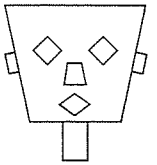
trapezoid

6. 

parallelogram

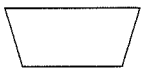
7. The neck and face in the drawing use special quadrilaterals. Write the most precise name for each part of the drawing.

eyes squares
nose trapezoid
neck rectangle
ears rectangles
mouth rhombus
face trapezoid



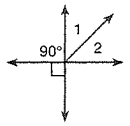
TEST PREP

8. What is the most precise name for this quadrilateral? *Skill 9*



A parallelogram
B quadrilateral
C rhombus
D trapezoid

9. What term best describes ∠1 and ∠2? *Skill 1*



F complementary
G perpendicular
H supplementary
J vertical

SKILL 10: Congruent Triangles

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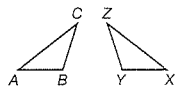
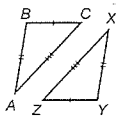
SKILL 10: Congruent Triangles

When two triangles are exactly the same shape and size, they are **congruent**. You can sometimes tell that triangles are congruent if you know that certain parts are congruent.

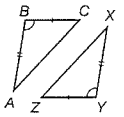


congruent triangles
triangle *ABC* ≅ triangle *XYZ*
Notice that corresponding vertices are in the same order.



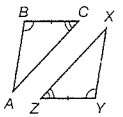
Side-Side-Side
SSS Rule

Two triangles are congruent if the three sides of one triangle are congruent to the three sides of the other triangle.



Side-Angle-Side
SAS Rule

Two triangles are congruent if two sides and the angle they form in one triangle are congruent to two sides and the angle they form in the other triangle.



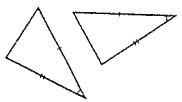
Angle-Side-Angle
ASA Rule

Two triangles are congruent if two angles and the side they include in one triangle are congruent to two angles and the side they include in the other triangle.

Example

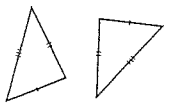
What rule tells you that the two triangles are congruent?

Look at the marks on the sides of the triangles. The angles marked with arcs are congruent. The pairs of corresponding sides that form the angles are congruent. So the triangles are congruent by the SAS rule.

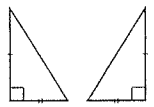


Guided Practice

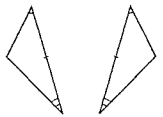
What rule tells you that the triangles are congruent?

1. 

SSS

2. 

SAS

3. 

ASA

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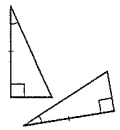
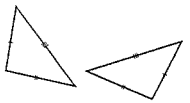
SKILL 10: Practice

What rule, if any, tells you that the two triangles are congruent?

1. 

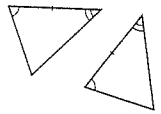
ASA

2. 

SSS

3. 

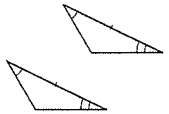
none

4. 

ASA

5. 

SAS

6. 

ASA

7. The measures of the angles of a triangle are 25°, 35°, and 120°. The measures of the angles of a second triangle are 120°, 35°, and 25°. Are the triangles congruent? How do you know?

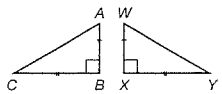
No; there is no rule that tells you that the two triangles are congruent. The triangles do not have to be the same size.

8. The measures of the sides of a triangle are 3 cm, 4 cm, and 5 cm. The measures of the sides of a second triangle are 3 cm, 4 cm, and 5.2 cm. Are the triangles congruent? How do you know?

No; the sides of lengths 5 cm and 5.2 cm are not congruent, so the triangles are not congruent.

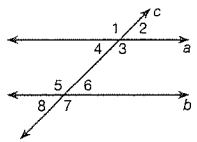
TEST PREP

9. What congruence rule for triangles tells you that triangle *ABC* ≅ triangle *WXY*? *Skill 10*



A ASA
C SSS
(B) SAS
D AAA

10. Lines *a* and *b* are parallel. Which angle is congruent to ∠7? *Skill 2*



(F) ∠1
G ∠2
H ∠6
J ∠8

SKILL 11: Slides, Flips, and Turns

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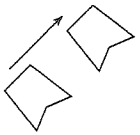
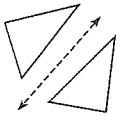
SKILL 11: Slides, Flips, and Turns

A **transformation** moves a figure to create a new figure called an **image**.

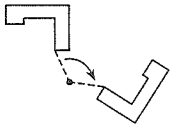
A **slide** moves the original points a specific distance in a specific direction.



A **flip** uses a line as a mirror and flips the original to form its mirror image.

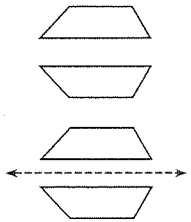


A **turn** rotates the original a certain number of degrees clockwise or counterclockwise around a point.



Example

What kind of transformation is shown at the right?



If you draw a dashed line half way between the trapezoids, you see that the image is the mirror reflection of the original over the line. The transformation is a flip.

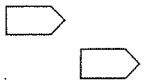
Guided Practice

What kind of transformation does each diagram show?

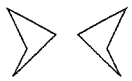
Ask yourself whether pushing the original in a straight line can give you the image. If yes, it is a slide. Or can you draw a line that acts as a mirror, as in the example? In that case, the transformation is a flip. Otherwise, it is a turn.

1. 

turn

2. 

slide

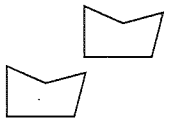
3. 

flip

Name _____ Date _____ Class _____

SKILL 11: Practice

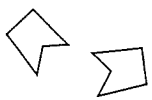
What kind of transformation does each diagram show?

1. 

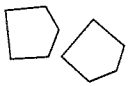
slide

2. 

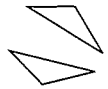
turn

3. 

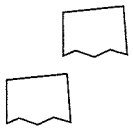
flip

4. 

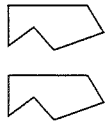
turn

5. 

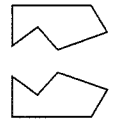
flip

6. 

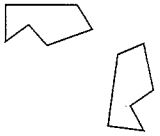
slide

7. 

slide

8. 

flip

9. 

turn

TEST PREP

10. Which transformation rotates the original around a point? *Skill 11*

A slide Ⓒ turn
B flip D image

11. If you mark 6 points on a circle, how many quadrilaterals have 4 of the points as vertices? *Skill 5*

Ⓕ 15 H 10
G 12 J 8

SKILL 12: Line Symmetry

Name _____ Date _____ Class _____

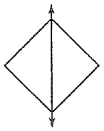
SKILL 12: Line Symmetry

A figure has **line symmetry** if it can be folded so that the two halves coincide exactly. The fold line is called the **line of symmetry**, and the two halves are congruent.

Example 1

Tell if the line is a line of symmetry.

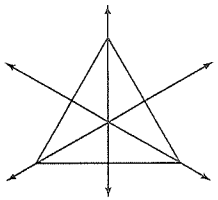
If the figure is folded on the line, the two parts would match exactly. So, the line is a line of symmetry.



Example 2

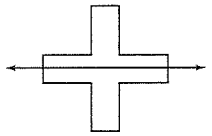
How many lines of symmetry does the figure have?

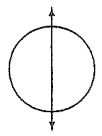
Find every line that produces two congruent halves that are mirror images of each other. The figure has 3 lines of symmetry.

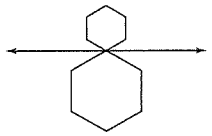


Guided Practice

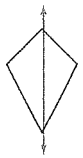
Tell if each line is a line of symmetry. Write *yes* or *no*.

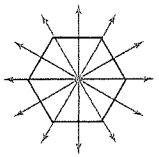
1.  yes

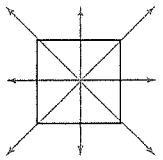
2.  yes

3.  no

How many lines of symmetry does each figure have? Draw the lines.

4.  1 line

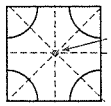
5.  6 lines

6.  4 lines

Name _____ Date _____ Class _____

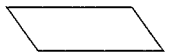
SKILL 12: Practice

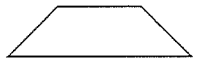
Tell whether the figure has line symmetry. If so, how many lines of symmetry does it have?

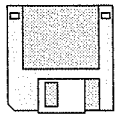
1.  yes; 4

2.  no

3.  yes; 8

4.  no

5.  yes; 1

6.  no

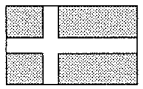
Tell how many lines of symmetry each figure has.

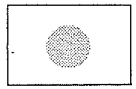
7.  1

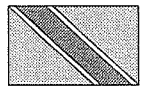
8.  2

9.  1

Tell how many lines of symmetry each flag has.

10. Sweden  1

11. Japan  2

12. Trinidad and Tobago  0

TEST PREP

13. How many lines of symmetry does a regular pentagon have? *Skill 12*

A 1 C 6
(B) 5 D 8

14. How many diagonals does a 20-sided polygon have? *Skill 5*

F 200 H 80
(G) 170 J 40

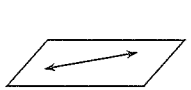
SKILL 13:
Lines and Planes in Space

Student pages 29–30

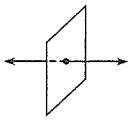
Name _____ Date _____ Class _____

SKILL 13: Lines and Planes in Space

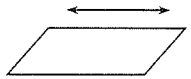
There are three possible relationships for a line and a plane in space.



The line is in the plane.

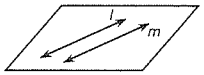


The line intersects the plane.

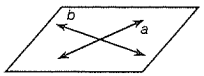


The line is parallel to the plane.

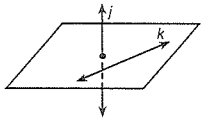
There are three possible relationships for two lines in space.



Lines *l* and *m* are in the same plane and are **parallel**. They never meet.



Lines *a* and *b* are are in the same plane and are **intersecting**.

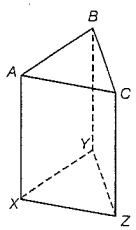


Lines *j* and *k* are not in the same plane. They never meet. They are **skew**.

Example

What is the relationship between $\overleftrightarrow{AX}$ and $\overleftrightarrow{CZ}$? between $\overleftrightarrow{AX}$ and $\overleftrightarrow{AC}$? between $\overleftrightarrow{AB}$ and $\overleftrightarrow{CZ}$?

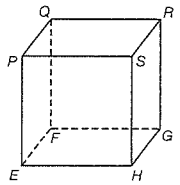
$\overleftrightarrow{AX}$ and $\overleftrightarrow{CZ}$ lie in the plane containing *ACZX*. Since the lines never intersect, $\overleftrightarrow{AX}$ and $\overleftrightarrow{CZ}$ are parallel. $\overleftrightarrow{AX}$ and $\overleftrightarrow{AC}$ meet at point *A*, so they are intersecting lines. $\overleftrightarrow{AB}$ and $\overleftrightarrow{CZ}$ do not lie in the same plane. So, $\overleftrightarrow{AB}$ and $\overleftrightarrow{CZ}$ are skew.



Guided Practice

What is the relationship between the figures?

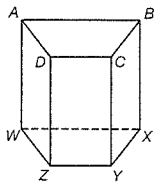
1. $\overleftrightarrow{HG}$ and the plane containing *PQRS* — parallel
2. $\overleftrightarrow{PQ}$ and the plane containing *PSHE* — intersecting
3. $\overleftrightarrow{QF}$ and $\overleftrightarrow{RG}$ — parallel
4. $\overleftrightarrow{PS}$ and $\overleftrightarrow{RG}$ — skew
5. $\overleftrightarrow{RS}$ and $\overleftrightarrow{SH}$ — intersecting



Name _____ Date _____ Class _____

SKILL 13: Practice

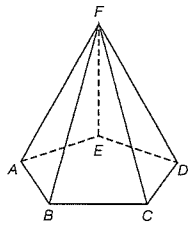
What is the relationship between the figures?



1. $\overleftrightarrow{DC}$ and the plane containing *ABXW* — parallel
2. $\overleftrightarrow{BC}$ and the plane containing *DCYZ* — intersecting
3. $\overleftrightarrow{WX}$ and $\overleftrightarrow{AB}$ — parallel
4. $\overleftrightarrow{AD}$ and $\overleftrightarrow{BC}$ — intersecting
5. $\overleftrightarrow{BC}$ and $\overleftrightarrow{WZ}$ — skew
6. $\overleftrightarrow{DZ}$ and $\overleftrightarrow{AB}$ — skew
7. $\overleftrightarrow{DZ}$ and $\overleftrightarrow{BX}$ — parallel
8. $\overleftrightarrow{AD}$ and $\overleftrightarrow{WZ}$ — parallel

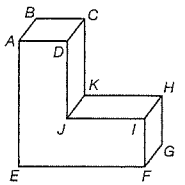
What is the relationship between the figures?

9. $\overleftrightarrow{FE}$ and $\overleftrightarrow{BC}$ — skew
10. $\overleftrightarrow{ED}$ and the plane containing triangle *FDC* — intersecting
11. $\overleftrightarrow{AB}$ and $\overleftrightarrow{DC}$ — intersecting
12. $\overleftrightarrow{FE}$ and the plane containing triangle *BCF* — intersecting



The diagram shows an L-shaped 3-D figure.

13. Name four lines parallel to $\overleftrightarrow{AB}$. — $\overleftrightarrow{CD}$, $\overleftrightarrow{FG}$, $\overleftrightarrow{HI}$, $\overleftrightarrow{JK}$
14. Name five lines that are skew to $\overleftrightarrow{EF}$. — $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, $\overleftrightarrow{CK}$, $\overleftrightarrow{GH}$, $\overleftrightarrow{HI}$, or $\overleftrightarrow{JK}$



TEST PREP

15. How many points do two skew lines have in common? *Skill 13*

(A) 0 C 2
B 1 D infinitely many

16. How many lines of symmetry does the figure have? *Skill 12*

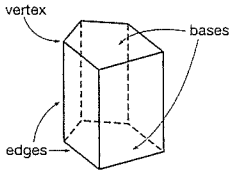
F 0 H 2
(G) 1 J 3

SKILL 14: Prisms and Pyramids

Name _____ Date _____ Class _____

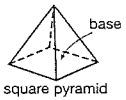
SKILL 14: Prisms and Pyramids

The figure at the right is a **prism**. The flat surfaces that make up the figure are polygons. These surfaces are the **faces** of the prism. Each corner point is a **vertex**. The segments where faces meet are the **edges** of the prism. Every prism has 2 faces that are parallel and congruent. They are the **bases**. Prisms are named by the shape of their bases. A pentagonal prism is shown in the example. The faces that are not bases are rectangles.



pentagonal prism

A **pyramid** has only one base. A pyramid is named by the shape of its base. The other faces are triangles which all meet at one point.

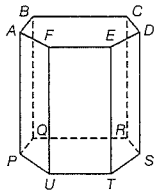


square pyramid

Example

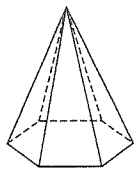
a. Name the type of figure shown at the right.
The figure is a hexagonal prism.

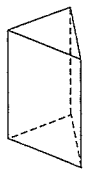
b. How does the number of edges compare with the number of sides of a base?
There are 18 edges. Each base has 6 sides. In a prism, the number of edges is 3 times the number of sides of a base.

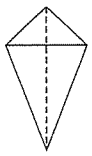


Guided Practice

Tell what type of figure is shown.

1. 
hexagonal pyramid

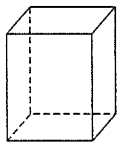
2. 
triangular prism

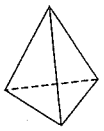
3. 
triangular pyramid

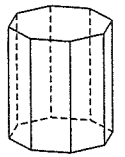
Name _____ Date _____ Class _____

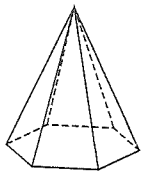
SKILL 14: Practice

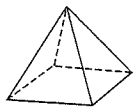
Name the type of figure. Tell how many vertices, faces, and edges it has.

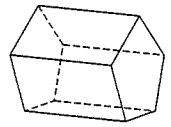
1. 
Type: rectangular prism
Vertices: 8
Faces: 6
Edges: 12

2. 
Type: triangular pyramid
Vertices: 4
Faces: 4
Edges: 6

3. 
Type: octagonal prism
Vertices: 16
Faces: 10
Edges: 24

4. 
Type: hexagonal pyramid
Vertices: 7
Faces: 7
Edges: 12

5. 
Type: square pyramid
Vertices: 5
Faces: 5
Edges: 8

6. 
Type: pentagonal prism
Vertices: 10
Faces: 7
Edges: 15

TEST PREP

7. How many faces does an octagonal pyramid have? *Skill 14*

A 10 C 8
(B) 9 D 7

8. What term describes two lines that do not lie in the same plane? *Skill 13*

F intersecting (H) skew
G perpendicular J parallel