Math grade 9ADV TERM3 2023/2024

Academic Year العام الدراسي	2023/2024
Term الفصل	3
Subject المادة	Mathematics/Reveal الرياضيات/ريفيل
Grade الصف	9
Stream المسار	Advanced المتقدم

MCQ

1	Statements, Conditionals, and Biconditionals	(1-6)	717

Use the statements to write a compound statement for each conjunction or disjunction. Then find the truth values. Explain your reasoning.

***p*: $-3 - 2 = -5$**

***q*: Vertical angles are congruent.**

***r*: $2 + 8 > 10$**

1. p and q

2. $p \wedge r$

3. $q \vee \sim r$

4. $r \vee q$

5. $\sim p \wedge \sim q$

6. $\sim r \vee \sim p$

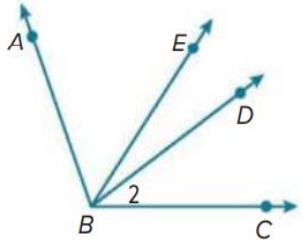
2	Proving Angle Relationships	(1-10)	753,754

Find the measure of each angle.

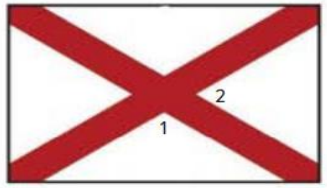
1. Find $m\angle ABC$ if $m\angle ABD = 70°$ and $m\angle DBC = 43°$.

2. If $m\angle EBC = 55°$ and $m\angle EBD = 20°$, find $m\angle 2$.

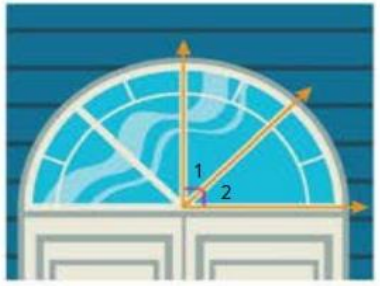
3. Find $m\angle ABD$ if $m\angle ABC = 110°$ and $m\angle 2 = 36°$.



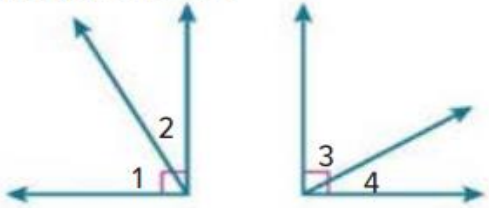
4. FLAGS The Alabama state flag is white and has two diagonal red stripes. If the $m\angle 1 = 112°$, what is $m\angle 2$?



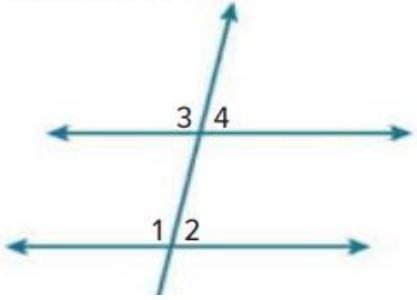
5. CONSTRUCTION Aaron has installed a new window above the entrance of an office building. If $m\angle 2 = 44°$, what is $m\angle 1$?



6. Given: $\angle 2 \cong \angle 4$
Prove: $\angle 1 \cong \angle 3$

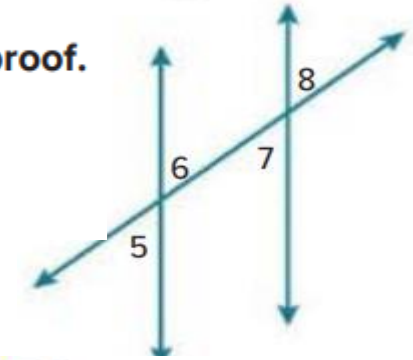


7. Given: $\angle 1 \cong \angle 3$
Prove: $\angle 2 \cong \angle 4$

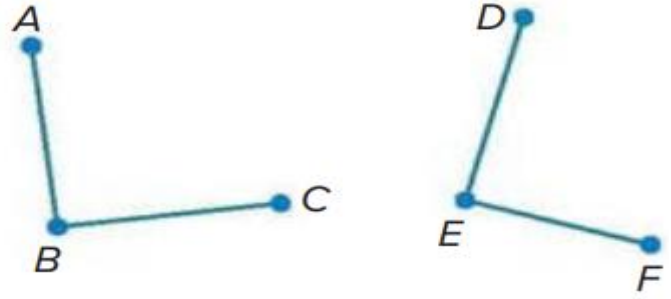


PROOF Write a two-column proof.

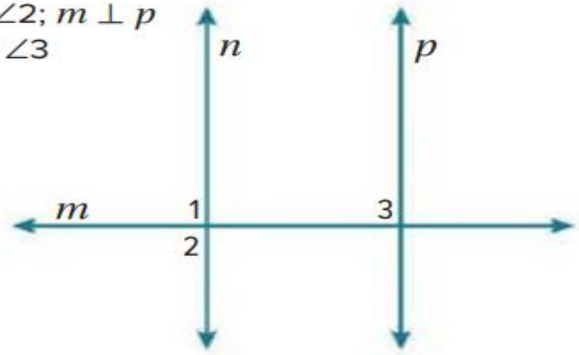
8. Given: $\angle 5 \cong \angle 7$
Prove: $\angle 5 \cong \angle 8$



9. Given: $m\angle ABC = m\angle DEF$
$\angle ABC$ and $\angle DEF$ are supplementary.
Prove: $\angle ABC$ and $\angle DEF$ are right angles.



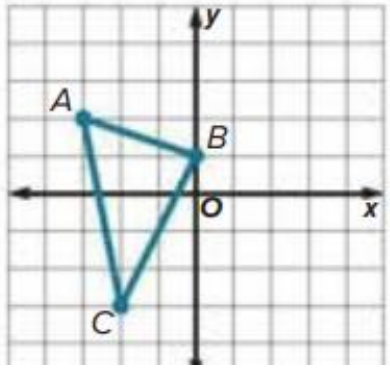
10. Given: $\angle 1 \cong \angle 2$; $m \perp p$
Prove: $\angle 2 \cong \angle 3$



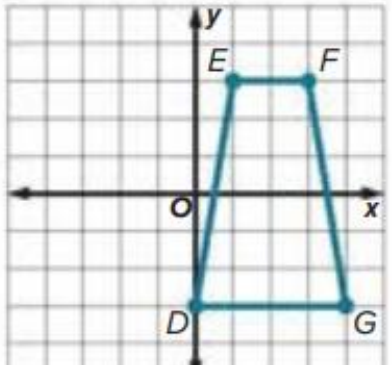
3	Reflections	(1-6)	801

Graph the image of each figure under the given reflection. Determine the coordinates of the image.

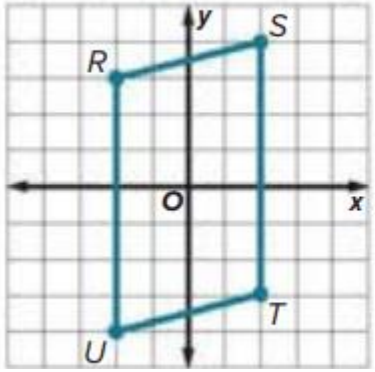
1. $\triangle ABC$ in the line $y = x$



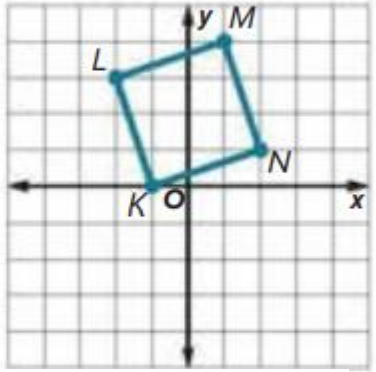
2. trapezoid $DEFG$ in the line $x = -1$



3. parallelogram $RSTU$ in the line $y = x$



4. square $KLMN$ in the line $y = -2$



5. Determine the coordinates of $S(-7, 1)$ after a reflection in the line $y = 3$.

6. Determine the coordinates of $Q(6, -4)$ after a reflection in the line $x = 2$.

4	Slope and Equations of Lines	(10-15)	771

Determine whether each pair of lines is *parallel*, *perpendicular*, or *neither*.

10. $y = 2x + 4, y = 2x - 10$

11. $y = -\frac{1}{2}x - 12, y - 3 = 2(x + 2)$

12. $y - 4 = 3(x + 5), y + 3 = -\frac{1}{3}(x + 1)$

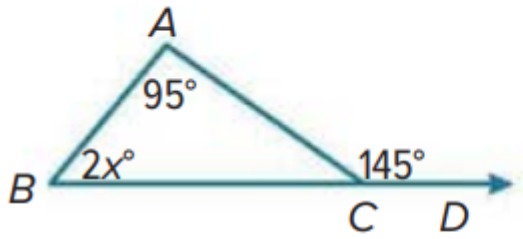
13. $y - 3 = 6(x + 2), y + 3 = -\frac{1}{3}(x - 4)$

14. $x = -2, y = 10$

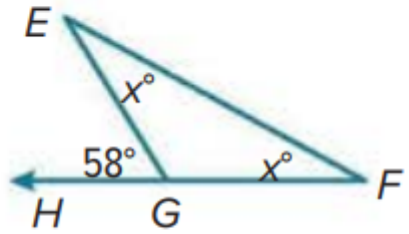
15. $y = 5, y = -3$

Find each measure.

5. $m\angle ABC$



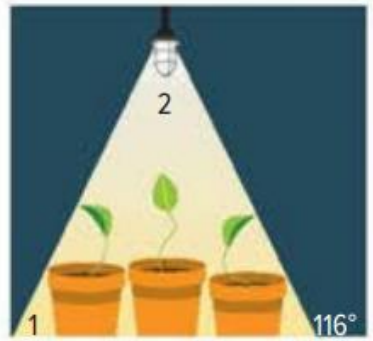
6. $m\angle F$



7. TOWERS A lookout tower sits on a network of struts and posts. Leslie measured two angles on the tower. If $m\angle 1 = (7x - 7)°$, $m\angle 2 = (4x + 2)°$, and $m\angle 3 = (2x + 6)°$, what is $m\angle 1$?



8. GARDENING A gardener uses a grow light to grow vegetables indoors. If $m\angle 1 = (8x)°$ and $m\angle 2 = (7x - 4)°$, what is $m\angle 1$?

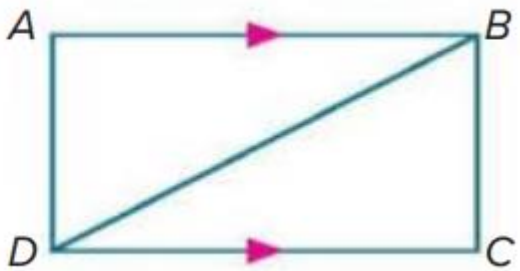


PROOF Write the specified type of proof.

1. two-column proof

Given: $\overline{AB} \parallel \overline{CD}$, $\angle CBD \cong \angle ADB$

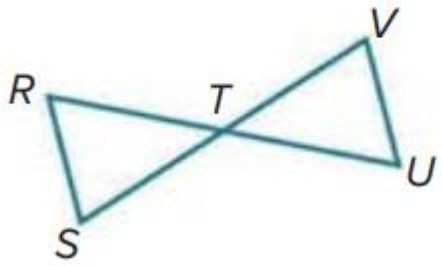
Prove: $\triangle ABD \cong \triangle CDB$



2. two-column proof

Given: $\angle S \cong \angle V$, and T is the midpoint of $\overline{SV}$.

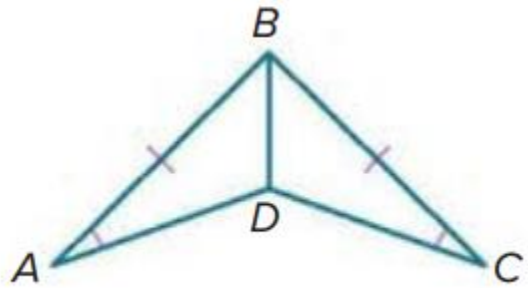
Prove: $\triangle RTS \cong \triangle UTV$



3. flow proof

Given: $\overline{AB} \cong \overline{CB}$, $\angle A \cong \angle C$, and $\overline{DB}$ bisects $\angle ABC$.

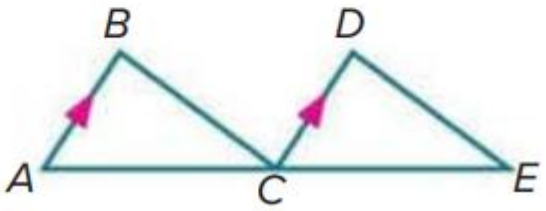
Prove: $\overline{AD} \cong \overline{CD}$



4. paragraph proof

Given: $\overline{CD}$ bisects $\overline{AE}$, $\overline{AB} \parallel \overline{CD}$, and $\angle E \cong \angle BCA$.

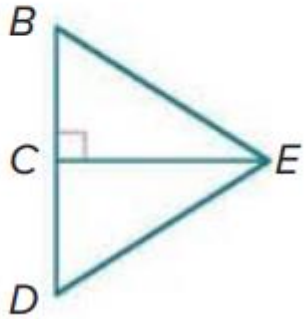
Prove: $\triangle ABC \cong \triangle CDE$



5. paragraph proof

Given: $\overline{CE}$ bisects $\angle BED$; $\angle BCE$ and $\angle ECD$ are right angles.

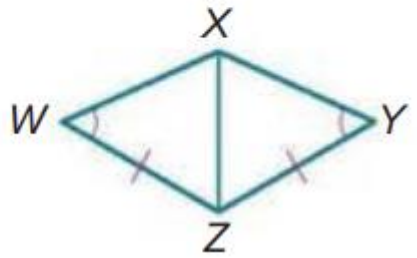
Prove: $\triangle ECB \cong \triangle ECD$



6. paragraph proof

Given: $\angle W \cong \angle Y$, $\overline{WZ} \cong \overline{YZ}$, and $\overline{XZ}$ bisects $\angle WZY$.

Prove: $\triangle XWZ \cong \triangle XYZ$



7	Conjectures and Counterexamples.	(1-8)	707

Write a conjecture that describes the pattern in each sequence. Then use your conjecture to find the next term in the sequence.

1. 4, 8, 12, 16, 20

Each term in the pattern is four more than the previous term; 24.

2. 2, 22, 222, 2222

Each term has an additional digit two as part of the number; 22222.

3. 1, $\frac{1}{2}$, $\frac{1}{4}$ $\frac{1}{8}$

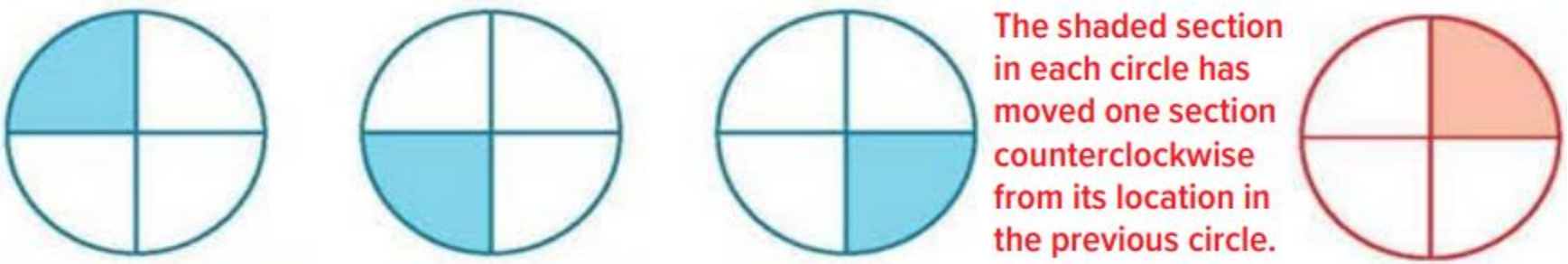
Each term is one half the previous term; $\frac{1}{16}$.

4. 6 , $\frac{11}{2}$5, , $\frac{9}{2}$ Each term is one half less than the previous term; $\frac{7}{2}$.

5. A rrival times: 3:00 P.M., 12:30 P.M., 10:00 A.M., . . . Each arrival time is 2 hours and 30 minutes prior to the previous arrival time; 7:30 A.M.

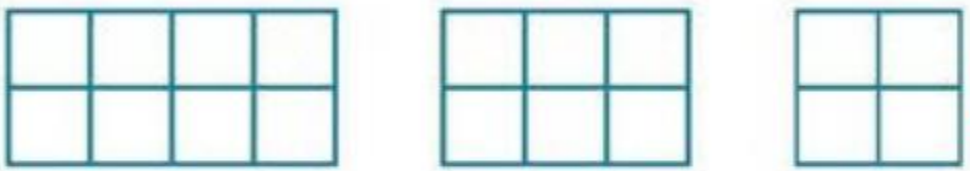
6. P ercent humidity: 100%, 93%, 86%, . . . Each percentage is 7% less than the previous percentage; 79%.

7.

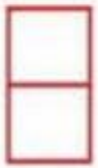


The shaded section in each circle has moved one section counterclockwise from its location in the previous circle.

8.



Each figure has one fewer column of squares than the previous figure.



8	Parallel Lines and Transversals	(8-19)	761

Identify the transversal connecting each pair of angles. Then classify the relationship between each pair of angles as *alternate interior*, *alternate exterior*, *corresponding*, or *consecutive interior* angles.

8. ∠4 and ∠5

9. ∠5 and ∠15

10. ∠12 and ∠14

11. ∠7 and ∠15

12. ∠2 and ∠12

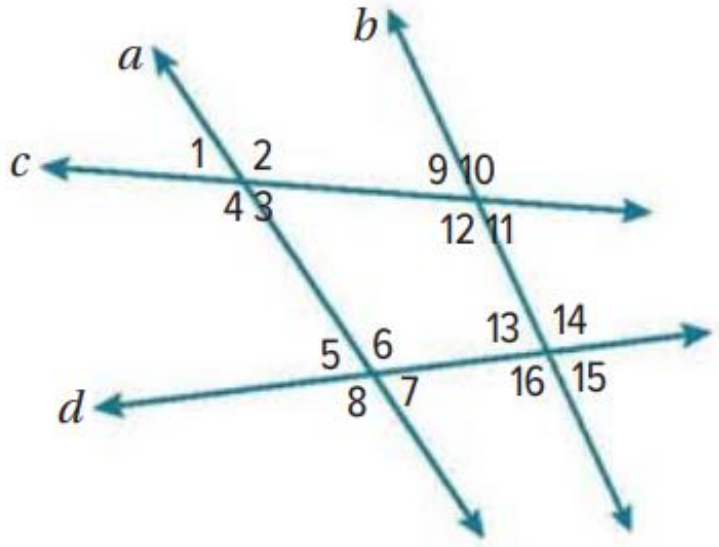
13. ∠3 and ∠6

14. ∠1 and ∠9

15. ∠3 and ∠9

16. ∠10 and ∠16

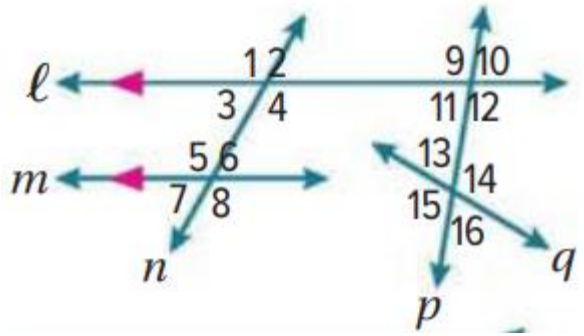
17. ∠5 and ∠13



For Exercises 18 and 19, use the figure.

18. What type of angles are ∠3 and ∠10?

19. State the transversal that connects ∠11 and ∠13.



MCQ

9	Slope and Equations of Lines	(22-27)	772

Write an equation in slope-intercept form for each line described.

22. passes through $(-7, -4)$, perpendicular to $y = \frac{1}{2}x + 9$

23. passes through $(-1, -10)$, parallel to $y = 7$

24. passes through $(6, 2)$, parallel to $y = -\frac{2}{3}x + 1$

25. passes through $(-2, 2)$, perpendicular to $y = -5x - 8$

Find the value of *x* or *y* that satisfies the given conditions. Then graph the line.

26. The line containing $(4, -2)$ and $(x, -6)$ is perpendicular to the line containing $(-2, -9)$ and $(3, -4)$.

27. The line containing $(-4, 9)$ and $(4, 3)$ is parallel to the line containing $(-8, 1)$ and $(4, y)$.

10	Perpendiculars and Distance	(9-20)	790

Find the distance between each pair of parallel lines with the given equations.

9. $y = 7$
$y = -1$
8 units

10. $x = -6$
$x = 5$
11 units

11. $y = 3x$
$y = 3x + 10$
$\sqrt{10}$ or about 3.16 units

12. $y = -5x$
$y = -5x + 26$
$\sqrt{26}$ or about 5.10 units

13. $y = x + 9$
$y = x + 3$
$3\sqrt{2}$ or about 4.24 units

14. $y = -2x + 5$
$y = -2x - 5$
$2\sqrt{5}$ or about 4.47 units

15. $y = \frac{1}{4}x + 2$
$4y - x = -60$
$4\sqrt{17}$ or about 16.49 units

16. $3x + y = 3$
$y + 17 = -3x$
$2\sqrt{10}$ or about 6.32 units

17. $y = -\frac{5}{4}x + 3.5$
$4y + 10.6 = -5x$
$\sqrt{14.76}$ or about 3.84 units

Find the distance from the line to the given point.

18. $y = -3$; $(5, 2)$
5 units

19. $y = \frac{1}{6}x + 6$; $(-6, 5)$
0 units

20. $x = 4$; $(-2, 5)$
6 units

11	Proving Lines Parallel	(1-6)	779

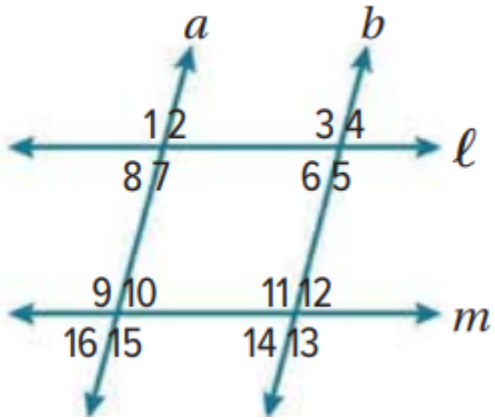
Use the given information to determine which lines, if any, are parallel. State the postulate or theorem that justifies your answer.

1. $\angle 3 \cong \angle 7$

2. $\angle 9 \cong \angle 11$

3. $\angle 2 \cong \angle 16$

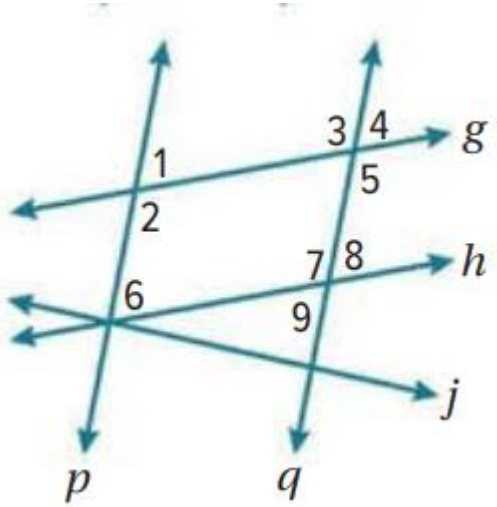
4. $m\angle 5 + m\angle 12 = 180°$



Given the following information, determine which lines, if any, are parallel. State the theorem that justifies your answer.

5. $\angle 1 \cong \angle 6$

6. $m\angle 7 + m\angle 6 = 180°$



MCQ

12	Symmetry	EX 3	828

Part A State the order and magnitude of symmetry.

Determine whether each figure has rotational symmetry. If so, locate the center of symmetry and state the order and magnitude of symmetry.

a.



rotational symmetry: yes

order = 5

magnitude = 72°

b.



rotational symmetry: no

order = none

magnitude = none

c.



rotational symmetry: yes

order = 2

magnitude = 180°

Part B Identify point symmetry.

Which figure(s) in Part A has point symmetry? Justify your reasoning.

The parallelogram has point symmetry because it can be rotated 180° about its center so it maps onto itself.

13	Translations	(8-14)	806

Name the image of each point after the given translation vector.

8. $F(-3, 1)$; $\langle 5, -1 \rangle$

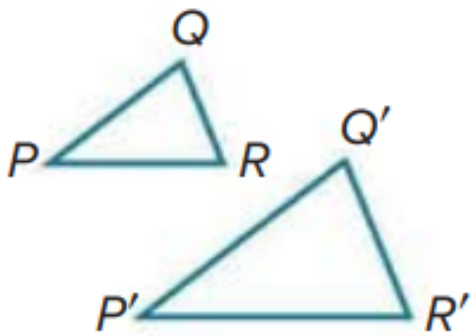
9. $Q(4, -2)$; $\langle -2, -5 \rangle$

10. $P(9, 1.5)$; $\langle 3, -0.5 \rangle$

11. The image of $A(-3, -5)$ under a translation is $A'(6, -1)$. Find the image of $B(3, -2)$ under the same translation.

12. CONSTRUCT ARGUMENTS Explain why $\triangle A'B'C'$ with vertices $A'(-1, -2)$, $B'(0, 0)$, and $C'(-6, 0)$ is not a translation image of $\triangle ABC$ with vertices $A(1, 2)$, $B(0, 0)$, and $C(6, 0)$.

13. Determine whether $\triangle P'Q'R'$ is a translation image of $\triangle PQR$. Explain.

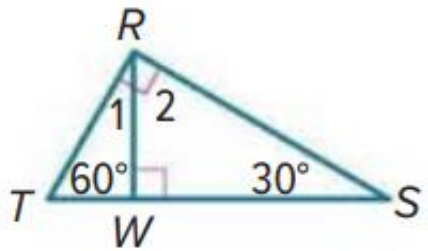


14. Determine the translation vector that moves every point of a preimage 4 units left and 6 units up.

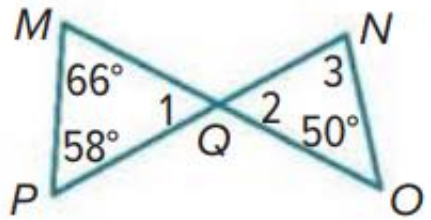
14	Angles of Triangles	(1-6)	843

Find the measure of each numbered angle.

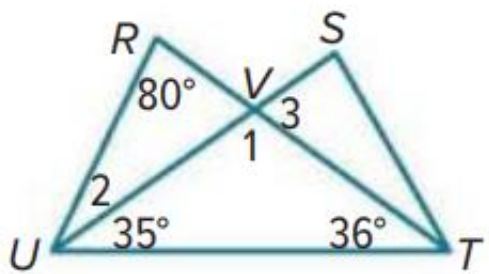
1.



2.



3.

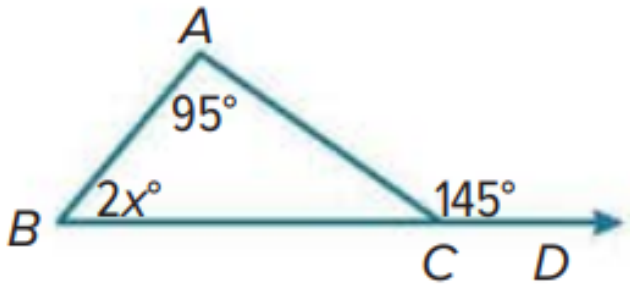


4.

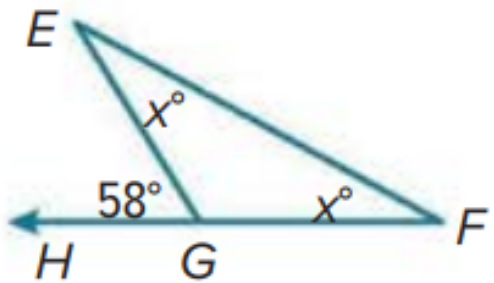


Find each measure.

5. $m\angle ABC$



6. $m\angle F$



15	Symmetry	(1-7)	829

Determine whether each figure has a line of symmetry. If so, draw the lines of symmetry and state how many lines of symmetry it has.

1.



2.



3.



4.



5.



6.



7. CARS Steve found the hubcaps shown below at his local junkyard. Determine whether each hubcap has rotational symmetry. Explain.

a.



b.



c.

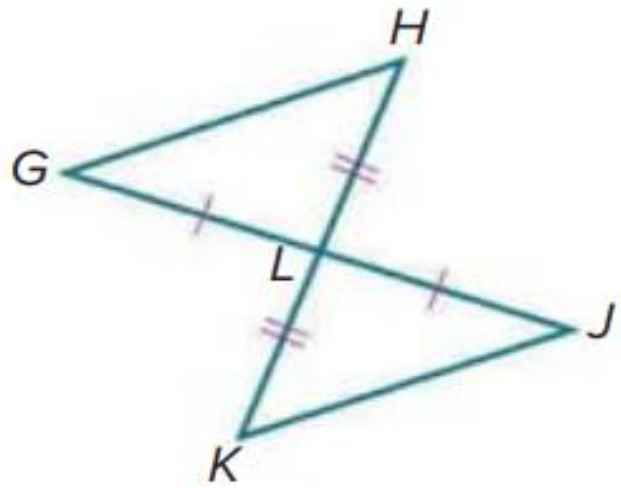


Part 2

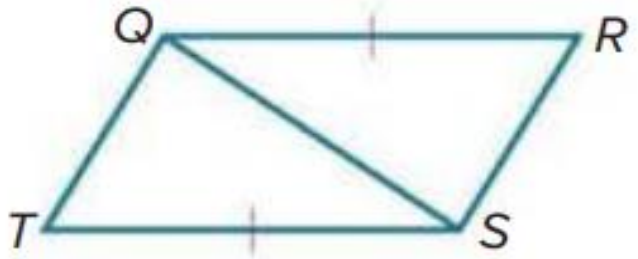
16	Proving Triangles Congruent – SSS, SAS	(17-20)	861

Explain whether there is enough information given in each figure to prove that the triangles are congruent using SSS or SAS.

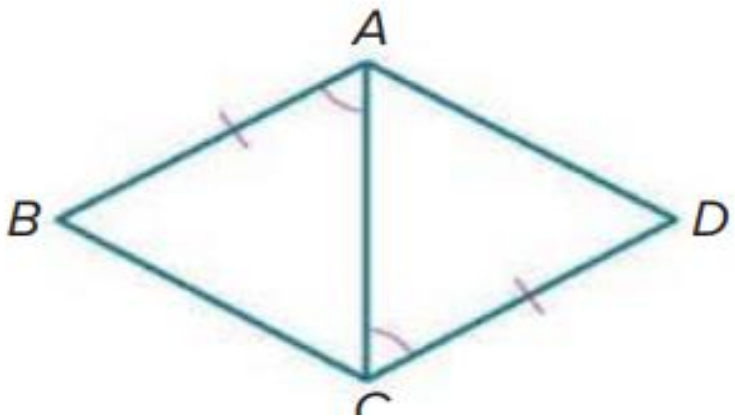
17.



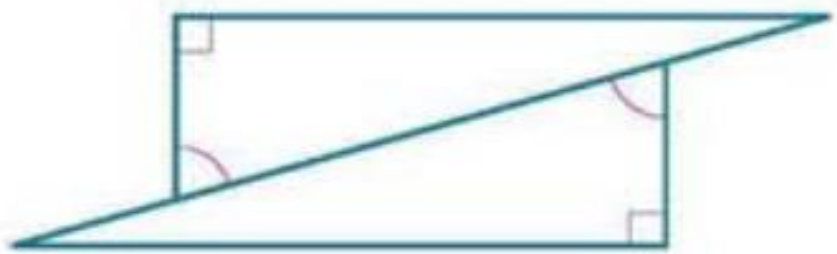
18.



19.

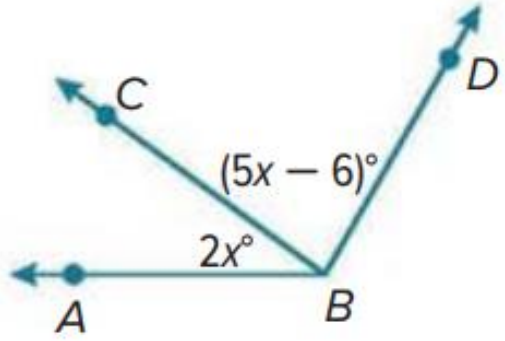


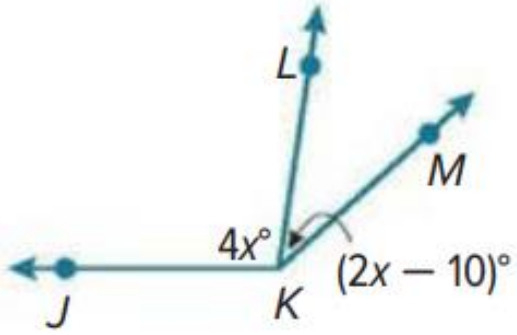
20.



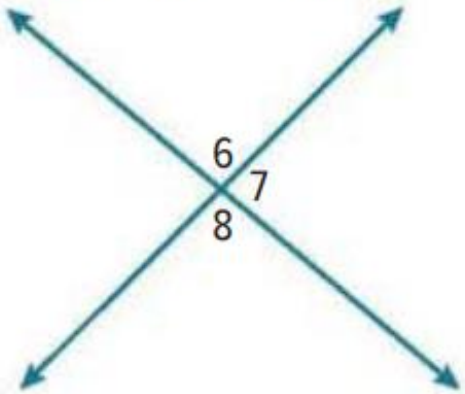
17	Proving Angle Relationships	(11-15)	754

11. Find $m\angle ABC$ and $m\angle CBD$ if $m\angle ABD = 120°$. **12.** Find $m\angle JKL$ and $m\angle LKM$ if $m\angle JKM = 140°$.

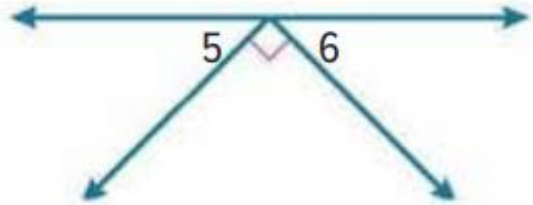




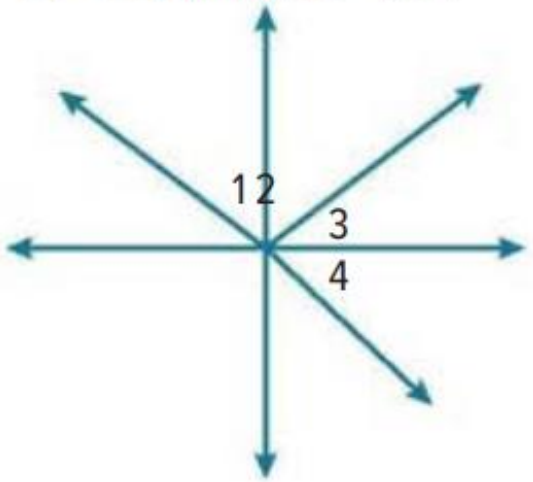
13. $m\angle 6 = (2x - 21)°$
$m\angle 7 = (3x - 34)°$



14. $m\angle 5 = m\angle 6$



15. $\angle 2$ and $\angle 3$ are complementary. $\angle 1 \cong \angle 4$ and $m\angle 2 = 28°$.



16. $\angle 2$ and $\angle 4$ and $\angle 4$ and $\angle 5$ are supplementary. $m\angle 4 = 105°$.



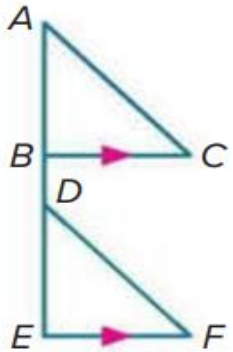
18	Proving Triangles Congruent – ASA, AAS	(10-15)	868,869

PROOF **Write the specified type of proof.**

10. two-column proof

Given: $\overline{BC} \parallel \overline{EF}$, $\overline{AB} \cong \overline{DE}$, $\angle C \cong \angle F$

Prove: $\triangle ABC \cong \triangle DEF$



Proof:

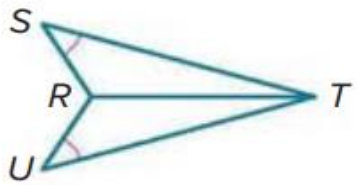
Statements (Reasons)

1. $\overline{BC} \parallel \overline{EF}$, $\overline{AB} \cong \overline{DE}$, $\angle C \cong \angle F$ (Given)
2. $\angle ABC \cong \angle DEF$ (Corresponding Angles Thm.)
3. $\triangle ABC \cong \triangle DEF$ (AAS)

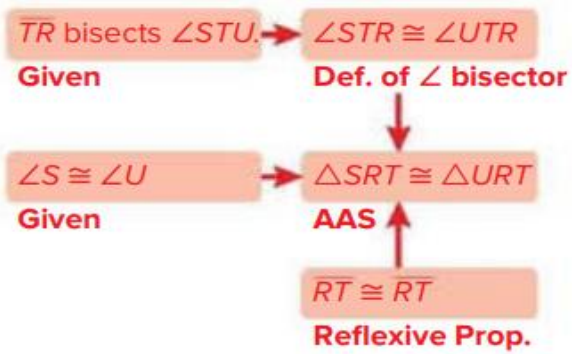
11. flow proof

Given: $\angle S \cong \angle U$, and $\overline{TR}$ bisects $\angle STU$.

Prove: $\triangle SRT \cong \triangle URT$



Proof:

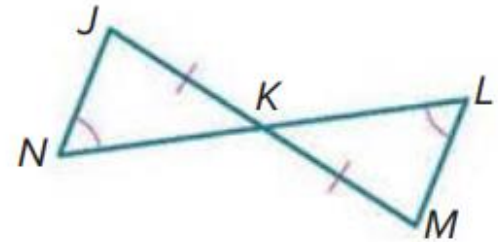


Write the specified type of proof.

12. flow proof

Given: $\overline{JK} \cong \overline{MK}$, $\angle N \cong \angle L$

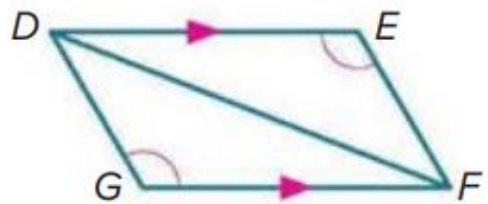
Prove: $\triangle JKN \cong \triangle MKL$



13. paragraph proof

Given: $\overline{DE} \parallel \overline{FG}$, $\angle E \cong \angle G$

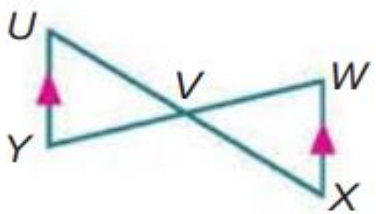
Prove: $\triangle DFG \cong \triangle FDE$



14. two-column proof

Given: V is the midpoint of $\overline{YW}$; $\overline{UY} \parallel \overline{XW}$,

Prove: $\triangle UVY \cong \triangle XVW$

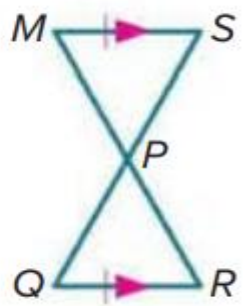


15. two-column proof

Given: $\overline{MS} \cong \overline{RQ}$,

$\overline{MS} \parallel \overline{RQ}$,

Prove: $\triangle MSP \cong \triangle RQP$

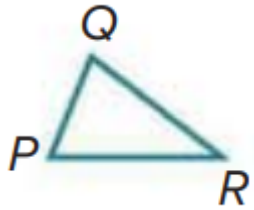


19	Rotations	(6-12)	809, 810

6. Point Q with coordinates $(4, -7)$ is rotated 270° clockwise about $(5, 1)$. What are the coordinates of its image? $Q'(13, 0)$

7. Parallelogram $JKLM$ has vertices $J(2, 1)$, $K(7, 1)$, $L(6, -3)$, and $M(1, -3)$. What are the coordinates of the image of K if the parallelogram is rotated 270° counterclockwise about $(-2, -1)$? $K'(0, -10)$

8. USE TOOLS Use a protractor and ruler to draw a rotation of $\triangle PQR$ 210° about T. See margin.



9. The line segment XY with endpoints $X(3, 1)$ and $Y(2, -2)$ is rotated 90° counterclockwise about $(-6, 4)$. What are the endpoints of $\overline{X'Y'}$?
$X'(-3, 13)$, $Y'(0, 12)$



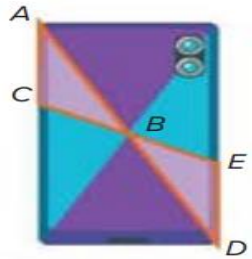
10. HIKING A damaged compass points northwest instead of north. If you travel west by the compass, what is your angle of rotation to true north? 45° clockwise or 315° counterclockwise

11. A circular dial with the digits 0 through 9 evenly spaced around its edge is rotated clockwise 36°. How many times would you have to perform this rotation in order to bring the dial back to its original position? 10 times

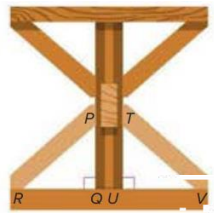
12. Under a rotation about the origin, the point $A(5, -1)$ is mapped to the point $A'(1, 5)$. What is the image of the point $B(-4, 6)$ under this rotation? Explain. $B'(-6, -4)$; The rotation maps (x, y) to $(-y, x)$, so it is a 90° rotation. Therefore, the image of $(-4, 6)$ is $(-6, -4)$.

20	Congruent Triangles	(12-16)	852

12. DESIGN Camila is designing a new image for her cell phone case. If $m\angle ABC = 35°$, $m\angle BAC = 29°$, and $\angle ACB \cong \angle DEB$, what is $m\angle DEB$?



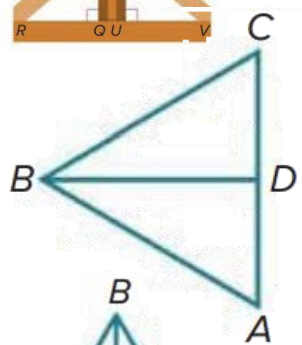
13. CARPENTRY Mr. Lewis is building a rustic dining table. Instead of having four legs, the table has a set of supports at each end. If $\angle PRQ \cong \angle TVU$ and $m\angle RPQ = 49°$, what is $m\angle TVU$?



PROOF **For 14–16, write a two-column proof.**

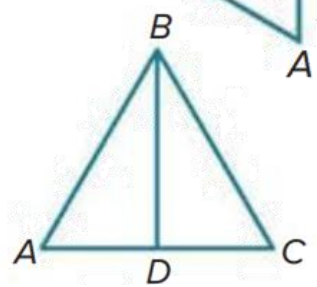
14. Given: $\overline{AB} \cong \overline{CB}$, $\overline{AD} \cong \overline{CD}$, $\angle BAD \cong \angle BCD$, $\overline{BD}$ bisects $\angle ABC$.

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



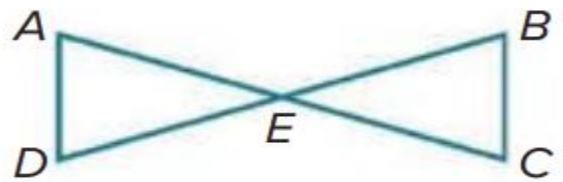
15. Given: $\overline{AB} \cong \overline{CB}$, $\overline{AD} \cong \overline{CD}$, $\angle ABD \cong \angle CBD$, $\angle ADB \cong \angle CDB$

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



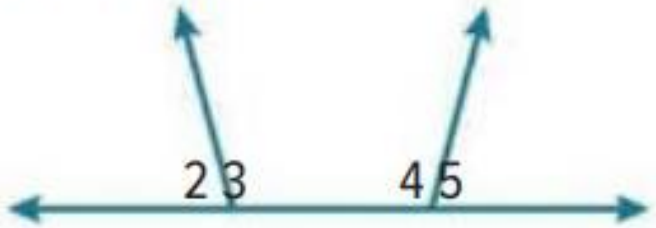
16. Given: $\angle A \cong \angle C$, $\angle D \cong \angle B$, $\overline{AD} \cong \overline{CB}$, $\overline{AE} \cong \overline{CE}$, $\overline{AC}$ bisects $\overline{BD}$.

Prove: $\triangle AED \cong \triangle CEB$

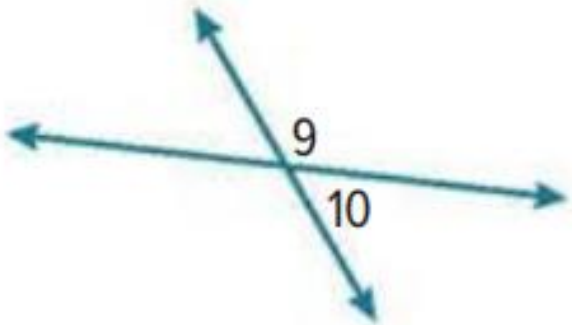


21	Proving Angle Relationships	(16-18)	754

16. $\angle 2$ and $\angle 4$ and $\angle 4$ and $\angle 5$ are supplementary. $m\angle 4 = 105°$.



17. $m\angle 9 = (3x + 12)°$
$m\angle 10 = (x - 24)°$



18. $m\angle 3 = (2x + 23)°$
$m\angle 4 = (5x - 112)°$

