EXERCISES

For more practice, see *Extra Practice.*

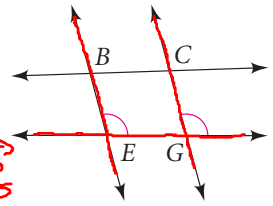
Practice and Problem Solving

A Practice by Example

Example 2 (page 123)

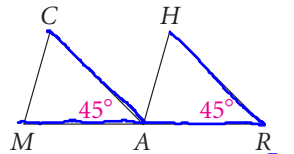
Developing Proof **Which lines or segments are parallel? Justify your answer with a theorem or postulate.**

1.



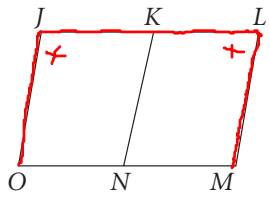
Corr. ∠s are ≅ ↔ BE // ↔ CG

2.



Corr. ∠s are ≅ $\overline{CA}$ // $\overline{HR}$

3.



$m\angle J + m\angle L = 180$

S-S-I ∠s are supple. $\overline{JO}$ // $\overline{LM}$

Developing Proof **Using the given information, which lines, if any, can you conclude are parallel? Justify each conclusion with a theorem or postulate.**

4. ∠2 is supplementary to ∠3. a // b

5. ∠6 is supplementary to ∠7. a // b

6. ∠4 is supplementary to ∠8. None

7. $m\angle 7 = 70, m\angle 9 = 110$ None

8. ∠1 ≅ ∠3 a // b

9. ∠9 ≅ ∠12

10. ∠3 ≅ ∠6

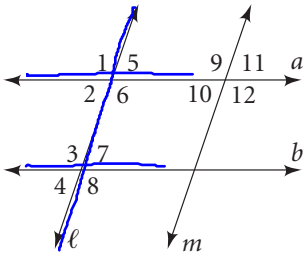
11. ∠2 ≅ ∠10

12. ∠1 ≅ ∠6

13. ∠8 ≅ ∠6

14. ∠11 ≅ ∠7

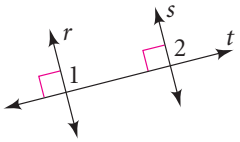
15. ∠5 ≅ ∠10



Examples 1, 3 (pages 123, 124)

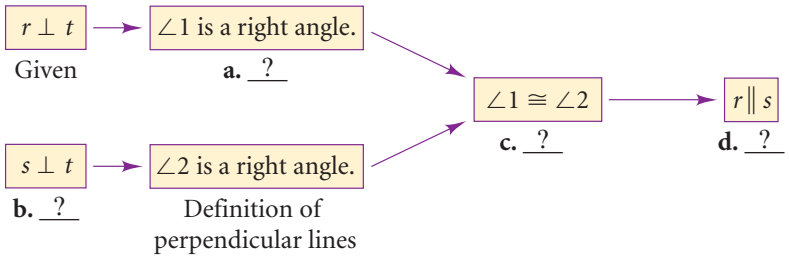
16. **Developing Proof** Complete this flow proof of Theorem 3-6.

In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.



Given: $r \perp t, s \perp t$

Prove: $r \parallel s$

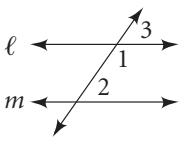


17. **Developing Proof** Complete this paragraph proof of Theorem 3-4.

If two lines and a transversal form supplementary same-side interior angles, then the two lines are parallel.

Given: ∠1 and ∠2 are supplementary.

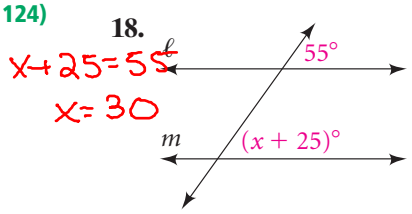
Prove: $\ell \parallel m$



Proof: ∠2 is a supplement of **a.** ? and ∠3 is a supplement of **b.** ?. Since supplements of the same angle are congruent, **c.** ? ≅ **d.** ?. Since ∠2 and ∠3 are also corresponding angles, $\ell \parallel m$ by the **e.** ? Postulate.

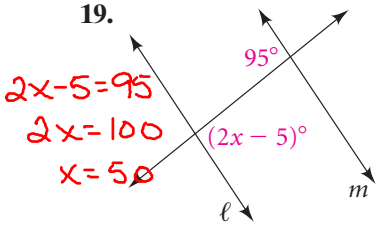
Example 4 (page 124) **Algebra** **Find the value of x for which $\ell \parallel m$.**

18.



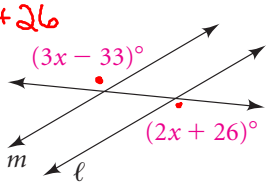
$x + 25 = 55$
$x = 30$

19.



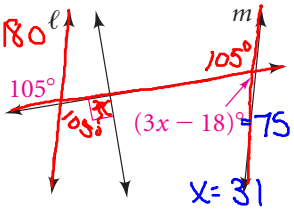
$2x - 5 = 95$
$2x = 100$
$x = 50$

20.



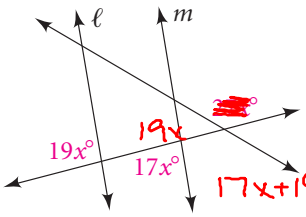
$3x - 33 = 2x + 26$
$x = 59$

21.



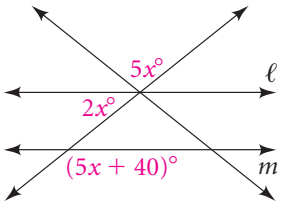
$3x - 18 + 105 = 180$
$3x + 87 = 180$
$x = 31$

22.



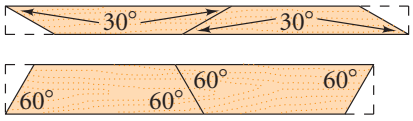
$17x + 19x = 180$
$36x = 180$
$x = 5$

23.

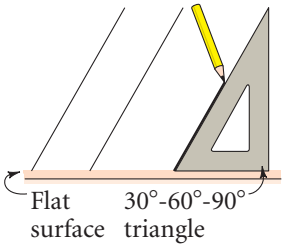


Example 5 (page 125)

24. The top and bottom of a frame are cut from the narrower piece of wood. The sides are cut from the wider piece of wood. Explain why the opposite sides of the frame will be parallel.



25. Drafting An artist uses the drawing tool in the diagram at the right. The artist draws a line, slides the triangle along the flat surface, and draws another line. Explain why the drawn lines must be parallel.



B Apply Your Skills

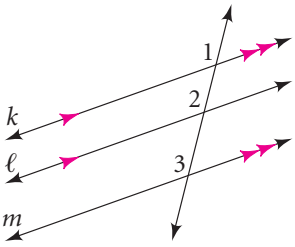
26. Developing Proof Copy and complete the paragraph proof of Theorem 3-5 for three coplanar lines.

If two lines are parallel to the same line, then they are parallel to each other.

Given: $\ell \parallel k$ and $m \parallel k$

Prove: $\ell \parallel m$

Proof: $\ell \parallel k$ means that $\angle 2 \cong \angle 1$ by the **a.** ? Postulate. $m \parallel k$ means that **b.** ? $\cong$ **c.** ? for the same reason. By the Transitive Property of Congruence, $\angle 2 \cong \angle 3$. By the **d.** ? Postulate, $\ell \parallel m$.



Reading Math

For help with reading and solving Exercise 26, see p. 130.

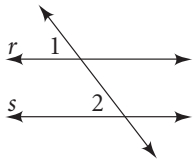
Algebra **Determine the value of x for which $r \parallel s$. Then find $m\angle 1$ and $m\angle 2$.**

27. $m\angle 1 = 80 - x$, $m\angle 2 = 90 - 2x$

28. $m\angle 1 = 60 - 2x$, $m\angle 2 = 70 - 4x$

29. $m\angle 1 = 40 - 4x$, $m\angle 2 = 50 - 8x$

30. $m\angle 1 = 20 - 8x$, $m\angle 2 = 30 - 16x$



31. Carpentry A T-bevel is a tool used by carpenters to draw congruent angles. By loosening the locking lever, the carpenter can adjust the angle. Explain how the carpenter knows that two lines drawn using the T-bevel are parallel.

Which sides of quadrilateral *PLAN* must be parallel? Explain.

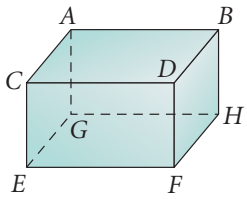
32. $m\angle P = 72, m\angle L = 108, m\angle A = 72, m\angle N = 108$

33. $m\angle P = 59, m\angle L = 37, m\angle A = 143, m\angle N = 121$

34. $m\angle P = 67, m\angle L = 120, m\angle A = 73, m\angle N = 100$

35. $m\angle P = 56, m\angle L = 124, m\angle A = 124, m\angle N = 5$

36. Writing Theorem 3-6: In a plane, two lines perpendicular to the same line are parallel. Use the rectangular solid at the right to explain why the words *in a plane* are needed.



Critical Thinking **The Reflexive, Symmetric, and Transitive Properties for Congruence (≅) are listed on page 91.**

Exercise 39

37. Write reflexive, symmetric, and transitive statements for "is parallel to" ($\parallel$). State whether each statement is true or false and justify your answer.

38. Repeat Exercise 37 for "is perpendicular to" ($\perp$).

39. Crew If the rowing crew at the left strokes in unison, the oars sweep out angles of equal measure. Explain why the oars on each side of the shell stay parallel.

Open-Ended **In each exercise, information is given about the figure below. State another fact about ∠1, ∠2, ∠3, or ∠4 that will guarantee two lines are parallel. Tell which lines will be parallel and why.**

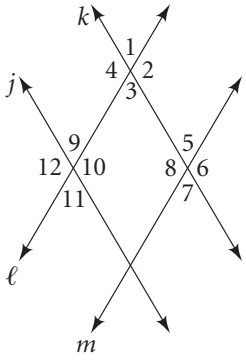
40. $\angle 1 \cong \angle 3$

41. $m\angle 8 = 70, m\angle 9 = 110$

42. $\angle 5 \cong \angle 11$

43. $\angle 11$ and $\angle 12$ are supplementary.

44. Reasoning If $\angle 1 \cong \angle 7$ in the diagram, what two theorems or postulates can you use to show that $\ell \parallel m$?



Challenge

Developing Proof **For Exercises 45 and 46, use the diagram at the right and this plan for a proof.**

Given: $\ell \parallel m, \angle 12 \cong \angle 8$

Prove: $j \parallel k$

Plan: To prove that $j \parallel k$, show that $\angle 12 \cong \angle 4$. It is given that $\angle 12 \cong \angle 8$, so $\angle 12 \cong \angle 4$ if $\angle 4 \cong \angle 8$. But $\angle 4 \cong \angle 8$ because $\ell \parallel m$ and corresponding angles are congruent.

45. Write a paragraph proof.

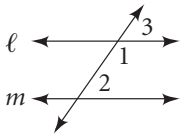
46. Write a flow proof.

47. Developing Proof Rewrite this paragraph proof of Theorem 3-4 as a flow proof.

If two lines and a transversal form supplementary same-side interior angles, then the two lines are parallel.

Given: $\angle 1$ and $\angle 2$ are supplementary.

Prove: $\ell \parallel m$



Proof: It is given that $\angle 1$ and $\angle 2$ are supplementary. $\angle 1$ and $\angle 3$ are also supplementary, so $\angle 2 \cong \angle 3$. Since $\angle 2$ and $\angle 3$ are corresponding angles, $\ell \parallel m$.

Need Help?

To show $\angle 1$ and $\angle 3$ are supplementary in Exercise 47, use the Angle Addition Postulate.

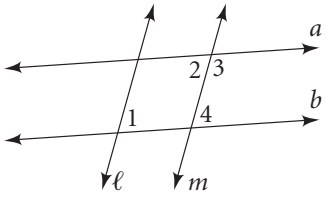
Proof **For Exercises 48 and 49, write a flow proof.**

48. Given: $a \parallel b, \angle 1 \cong \angle 2$

Prove: $\ell \parallel m$

49. Given: $\ell \parallel m$, $\angle 1$ is supplementary to $\angle 3$.

Prove: $a \parallel b$



Proof **50.** Prove the following statement is true by following the steps below:

If a transversal intersects two parallel lines, then the bisectors of two corresponding angles are parallel.

a. Draw and label a diagram on paper.
b. State what is given and mark the diagram to keep track of the information.
c. State what you are to prove.
d. Write a plan for proof.
e. Follow your plan and write the proof.

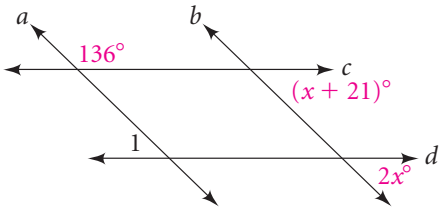
Standardized Test Prep

Multiple Choice

51. If a, b, c, and d are coplanar lines and $a \parallel b$, $b \perp c$, and $c \parallel d$, then which statement must be true?

A. $d \perp c$ **B.** $c \parallel a$ **C.** $d \perp a$ **D.** $d \parallel b$

Use the diagram for Exercises 52–54.



52. For what value of x is $c \parallel d$?

F. 21 **G.** 23
H. 43 **I.** 53

53. If $c \parallel d$, what is $m\angle 1$?

A. 24 **B.** 44
C. 136 **D.** 146

Short Response

54. Suppose $a \parallel b$ in the diagram above.
a. Write and solve an equation to find the value of x.
b. Write and solve an equation to find whether $c \parallel d$. Explain your answer.

Extended Response

55. Two lines, a and b, are cut by a transversal t. $\angle 1$ and $\angle 2$ are any pair of corresponding angles. $\angle 1$ and $\angle 3$ are adjacent angles. $m\angle 1 = 2x - 38$, $m\angle 2 = x$, and $m\angle 3 = 6x + 18$.
a. Draw and label a diagram for the figure described.
b. Determine whether lines a and b are parallel. Justify your answer.

Take It to the NET
Online lesson quiz at **www.PHSchool.com**
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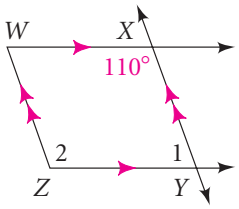
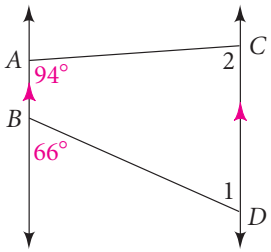
Mixed Review

Lesson 3-1 **Find $m\angle 1$, and then $m\angle 2$. Justify each answer.**

56.



57.



Lesson 2-1 **Write the converse of each conditional statement. Determine the truth values of the original conditional and its converse.**

58. If you are in Nebraska, you are west of the Mississippi River.

59. If a circle has a diameter of 8 cm, then it has a radius of 4 cm.

60. If a line intersects a pair of parallel lines, then same-side interior angles are supplementary.

61. If you add *ed* to a verb, you form the past tense of a verb.

62. If it is raining, then there are clouds in the sky.

Lesson 1-7 **Find the area of each circle. Round to the nearest tenth.**

63. $r = 8$ in.

64. $d = 6$ cm

65. $d = 9$ ft

66. $r = 5$ in.

67. $d = 2.8$ m

68. $r = 1.2$ m

69. $d = 4.75$ ft

70. $r = 0.6$ m