

# Parallel Lines and Transversals

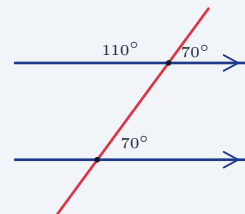
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## Quick Review and Helpful Hints

When a transversal crosses two parallel lines, special angle pairs form: *corresponding* angles are equal, *alternate interior* angles are equal, and *alternate exterior* angles are equal. *Co-interior* (same-side interior) angles are supplementary (add to  $180^\circ$ ), and any *linear pair* on a line is also supplementary. Vertical angles are equal.

▷ **Example:** Two parallel lines are cut by a transversal, making a  $70^\circ$  angle. Find its corresponding angle and its co-interior angle.

**Work:** Corresponding angles are equal, so one is  $70^\circ$ . Co-interior angles are supplementary, so the other is  $180 - 70$ . ★ **Answer:**  $70^\circ$  and  $110^\circ$



Corresponding angles equal;  
co-interior add to  $180^\circ$ .

### Practice Problems

Find the measure of the requested angle.

- |   |       |   |       |
|---|-------|---|-------|
| 1. Corresponding angle of $65^\circ$      | _____ | 8. Linear-pair angle of $130^\circ$         | _____ |
| 2. Alternate interior angle of $80^\circ$ | _____ | 9. Corresponding angle of $90^\circ$        | _____ |
| 3. Co-interior angle of $110^\circ$       | _____ | 10. Alternate interior angle of $35^\circ$  | _____ |
| 4. Vertical angle of $45^\circ$           | _____ | 11. Co-interior angle of $60^\circ$         | _____ |
| 5. Corresponding angle of $120^\circ$     | _____ | 12. Vertical angle of $100^\circ$           | _____ |
| 6. Co-interior angle of $75^\circ$        | _____ | 13. Linear-pair angle of $95^\circ$         | _____ |
| 7. Alternate exterior angle of $50^\circ$ | _____ | 14. Alternate exterior angle of $145^\circ$ | _____ |

### Word Problems

15. Two parallel lines are cut by a transversal. What is the angle corresponding to a  $72^\circ$  angle? \_\_\_\_\_
16. Same-side interior angles are formed by parallel lines. One is  $115^\circ$ . Find the other. \_\_\_\_\_
17. Alternate interior angles are formed by parallel lines. One is  $48^\circ$ . Find the other. \_\_\_\_\_
18. A transversal makes a  $130^\circ$  angle with a line. What is the angle next to it (its linear pair)? \_\_\_\_\_



◆ Illustrated Practice

Use each picture. Match the angle relationship first, then find the missing value.

19. Corresponding angles.  
Find  $x$ . \_\_\_\_\_

25. Corresponding angles.  
Find  $x$ . \_\_\_\_\_

20. Same-side interior angles.  
Find  $x$ . \_\_\_\_\_

26. Same-side interior angles.  
Find  $x$ . \_\_\_\_\_

21. Alternate interior angles.  
Find  $x$ . \_\_\_\_\_

27. Alternate interior angles.  
Find  $x$ . \_\_\_\_\_

22. Linear pair on  $l_1$ . Find  $x$ . \_\_\_\_\_

28. Corresponding angles.  
Find  $x$ . \_\_\_\_\_

23. Vertical angles. Find  $x$ . \_\_\_\_\_

29. Same-side interior equation. Find  $x$ . \_\_\_\_\_

24. Alternate exterior angles.  
Find  $x$ . \_\_\_\_\_

30. What angle relationship is shown? \_\_\_\_\_



## Answer Keys

- |                                      |                                       |   |
|--------------------------------------|---------------------------------------|---|
| 1. <input type="text" value="65°"/>  | 11. <input type="text" value="120°"/> | 21. <input type="text" value="47°"/>    |
| 2. <input type="text" value="80°"/>  | 12. <input type="text" value="100°"/> | 22. <input type="text" value="42°"/>    |
| 3. <input type="text" value="70°"/>  | 13. <input type="text" value="85°"/>  | 23. <input type="text" value="76°"/>    |
| 4. <input type="text" value="45°"/>  | 14. <input type="text" value="145°"/> | 24. <input type="text" value="121°"/>   |
| 5. <input type="text" value="120°"/> | 15. <input type="text" value="72°"/>  | 25. <input type="text" value="x = 16"/> |
| 6. <input type="text" value="105°"/> | 16. <input type="text" value="65°"/>  | 26. <input type="text" value="x = 22"/> |
| 7. <input type="text" value="50°"/>  | 17. <input type="text" value="48°"/>  | 27. <input type="text" value="x = 11"/> |
| 8. <input type="text" value="50°"/>  | 18. <input type="text" value="50°"/>  | 28. <input type="text" value="58°"/>    |
| 9. <input type="text" value="90°"/>  | 19. <input type="text" value="64°"/>  | 29. <input type="text" value="x = 25"/> |
| 10. <input type="text" value="35°"/> | 20. <input type="text" value="68°"/>  | 30. Alternate exterior                  |

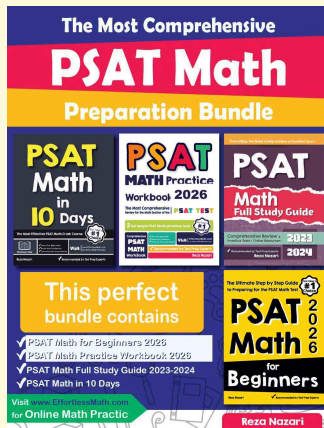
### Step-by-Step Explanations

1. Corresponding angles are in the same relative position at the two crossings. Because the lines are parallel, those angles are equal, so the requested angle is  $65^\circ$ .
2. Alternate interior angles are inside the parallel lines and on opposite sides of the transversal. For parallel lines they are equal, so the angle measure stays  $80^\circ$ .
3. Co-interior angles are on the same side of the transversal between the parallel lines, so they add to  $180^\circ$ . Subtract the given angle:  $180 - 110 = 70$ , so the missing angle is  $70^\circ$ .
4. Vertical angles are the opposite angles made by two intersecting lines. Opposite angles match exactly, so the vertical angle is also  $45^\circ$ .
5. Use the corresponding-angle rule again: same position at each crossing means same measure when the lines are parallel. The corresponding angle is  $120^\circ$ .
6. Co-interior angles are supplementary, which means their sum is  $180^\circ$ . Compute  $180 - 75 = 105$ , so the missing angle is  $105^\circ$ .
7. Alternate exterior angles are outside the parallel lines and on opposite sides of the transversal. They are congruent, so the angle is  $50^\circ$ .
8. A linear pair forms a straight line, and a straight angle is  $180^\circ$ . Subtract the known angle:  $180 - 130 = 50$ , so the angle next to it is  $50^\circ$ .
9. Corresponding angles keep the same corner position at the two intersections. Since corresponding angles are equal, the answer is  $90^\circ$ .
10. Alternate interior angles match when the two lines are parallel. The given angle is  $35^\circ$ , so the alternate interior angle is also  $35^\circ$ .
11. Same-side interior angles are supplementary, so start from  $180^\circ$  and subtract the given angle.  $180 - 60 = 120$ , so the missing angle is  $120^\circ$ .
12. Vertical angles are opposite each other at one crossing, and opposite angles are equal. That makes the requested angle  $100^\circ$ .
13. Angles in a linear pair sit side by side on a straight line, so they total  $180^\circ$ .  $180 - 95 = 85$ , so the missing angle is  $85^\circ$ .
14. Alternate exterior angles are equal for parallel lines cut by a transversal. Since one exterior angle is  $145^\circ$ , the alternate exterior angle is  $145^\circ$ .
15. The problem asks for a corresponding angle, so look for the same position at the other crossing. Corresponding angles are equal, so the answer is  $72^\circ$ .
16. Same-side interior angles add to  $180^\circ$ . Subtract the known angle from 180:  $180 - 115 = 65$ , so the other angle is  $65^\circ$ .
17. Alternate interior angles are equal when the lines are parallel. The matching angle is therefore  $48^\circ$ .
18. The angle next to a  $130^\circ$  angle forms a linear pair with it. Linear pairs add to  $180^\circ$ , so  $180 - 130 = 50^\circ$ .
19. The diagram marks corresponding angles, which means the two angles sit in matching positions at the two intersections. Matching positions have equal measures, so  $x = 64^\circ$ .
20. Same-side interior angles are the pair inside the parallel lines on the same side of the transversal. They must add to  $180^\circ$ , so  $x = 180 - 112 = 68^\circ$ .
21. These are alternate interior angles: inside the two lines, but on opposite sides of the transversal. Alternate interior angles are equal, so  $x = 47^\circ$ .
22. The two marked angles share a straight line, so they form a linear pair. A straight line is  $180^\circ$ , so  $x = 180 - 138 = 42^\circ$ .
23. The marked angles are vertical angles at the same intersection. Vertical angles are congruent, so  $x = 76^\circ$ .
24. The angles are outside the parallel lines and on opposite sides of the transversal, so they are alternate exterior angles. Alternate exterior angles are equal, giving  $x = 121^\circ$ .
25. Corresponding angles are equal, so set the expressions equal:  $3x + 12 = 5x - 20$ . Add 20 to both sides and subtract  $3x$  from both sides to get  $32 = 2x$ , so  $x = 16$ .
26. Same-side interior angles are supplementary, so their expressions must add to  $180^\circ$ . Write  $(4x + 8) + (2x + 40) = 180$ , combine to get  $6x + 48 = 180$ , then solve  $6x = 132$  and  $x = 22$ .
27. Alternate interior angles are equal, so set the two expressions equal:  $6x - 5 = 4x + 17$ . Subtract  $4x$  and add 5 to get  $2x = 22$ , so  $x = 11$ .
28. The two marked angles are in corresponding positions. Corresponding angles are equal when the lines are parallel, so  $x = 58^\circ$ .
29. Same-side interior angles add to  $180^\circ$ , so write  $(x + 35) + (2x + 70) = 180$ . Combine like terms to get  $3x + 105 = 180$ , then  $3x = 75$ , so  $x = 25$ .
30. Angles  $A$  and  $B$  are both outside the parallel lines and on opposite sides of the transversal. That location makes them alternate exterior angles.



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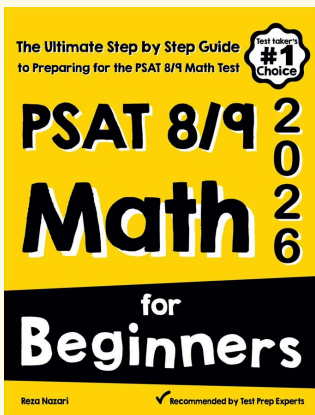
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