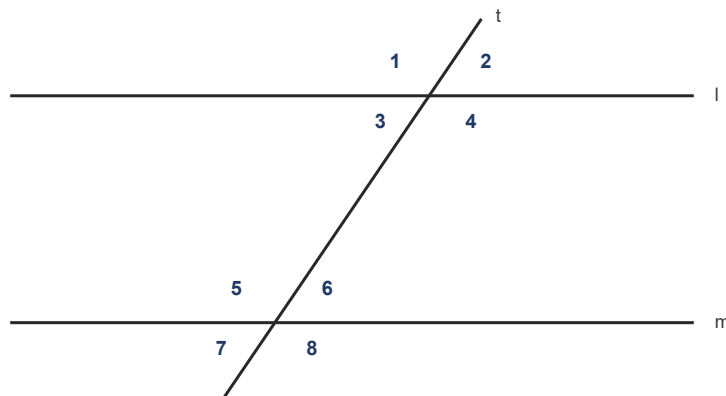


Parallel lines cut by a transversal: the eight angles and the named pairs

Two parallel lines l and m and a transversal t make eight angles with only two sizes: every acute angle is equal, every obtuse angle is equal, and an acute plus an obtuse makes 180° . The names say WHY two angles are equal or supplementary. Numbering: 1 top-left, 2 top-right, 3 bottom-left, 4 bottom-right at the upper crossing; 5 to 8 the same at the lower crossing.



Pair	Where	Shape	When $l \parallel m$	Pairs
Corresponding	same position at each crossing	F	equal	1 & 5, 2 & 6, 3 & 7, 4 & 8
Alternate interior	opposite sides of t , between l and m	Z	equal	3 & 6, 4 & 5
Alternate exterior	opposite sides of t , outside	stretched Z	equal	1 & 8, 2 & 7
Co-interior (same-side interior)	same side of t , between	C or U	add to 180°	3 & 5, 4 & 6
Co-exterior	same side, outside		add to 180°	1 & 7, 2 & 8
Vertically opposite	across one crossing	X	equal (any lines)	1 & 4, 2 & 3, 5 & 8, 6 & 7
Linear pair	side by side on a line		add to 180° (any lines)	1 & 2, 1 & 3, 5 & 6 ...

Converses (proving $l \parallel m$) and the perpendicular transversal theorems

[] If corresponding angles are equal, or alternate angles are equal, or co-interior angles add to 180° , the lines are parallel. One pair is enough; name it

[] A transversal perpendicular to one of two parallel lines is perpendicular to the other; two lines perpendicular to the same line are parallel; two lines parallel to the same line are parallel

From

sciencewithshobha.com/blog/parallel-lines-cut-by-a-transversal-the-eight-angle-pairs-corresponding-alternate-co-interior-vertical-which-are-equal-and-which-add-to-180-the-perpendicular-transversal-theorems-and-practice/ · 1-on-1 online maths, KS2 to A level, Grades 3 to 12, free 30-minute first class.

Worked examples, the mistakes, and a practice set

- [] Angle 1 = 65° : 4 = 65 (vertically opposite), 2 = 3 = 115 (linear pairs), 5 = 65 (corresponding), 8 = 65, 6 = 7 = 115
- [] Alternate interior $(2x + 15)^\circ$ and $(3x - 20)^\circ$: equal, $x = 35$, each 85°
- [] Corresponding $(3x + 10)^\circ$ and $(5x - 30)^\circ$: equal, $x = 20$, each 70°
- [] Co-interior $(4x)^\circ$ and $(2x + 30)^\circ$: add to 180, $x = 25$, angles 100° and 80°
- [] Alternate interior angles 72° and 72° : equal, so by the converse the lines are parallel
- [] Corresponding angles 68° and 71° : not equal, not parallel; the lines meet on the side of the smaller angles

Mistakes

- [] Co-interior angles called equal (they add to 180°)
- [] Parallel-line facts used when the lines are not marked parallel (only vertically opposite and linear pairs hold for any lines)
- [] Writing 'Z angles' or 'F angles' as a reason (write alternate or corresponding)
- [] Alternate (Z, opposite sides) confused with co-interior (C, same side)
- [] An algebra pair set equal when it is supplementary, or the reverse: identify the pair first

Curriculum	Where
US	Grade 8 8.G.5; Geometry HSG-CO.C.9 proofs
England	KS3 alternate and corresponding; GCSE co-interior and multi-step reasons
Australia	Year 7 corresponding, alternate, co-interior
CBSE	Class 7 Lines and Angles; Class 9 proofs

Practice (use the numbering from page 1)

1. Angle 2 is 112° . Find angles 3, 5 and 8, naming the pair you used each time.
2. Alternate interior angles $(5x - 10)^\circ$ and $(3x + 30)^\circ$. Find x and the angles.
3. Co-interior angles $(7x)^\circ$ and $(2x + 45)^\circ$. Find x and both angles.
4. A transversal makes 90° with one of two parallel lines. Its angle with the other, and the theorem?
5. Co-interior angles measure 95° and 85° . Are the lines parallel? Why?
6. Corresponding angles $(4x + 8)^\circ$ and $(6x - 22)^\circ$. Find x ; for that x are the lines parallel?
7. Angle 6 is 54° . Find angles 1 and 7.
8. Name every angle equal to angle 3, and every angle supplementary to it.

Answers

1. 3 = 112° (vertically opposite to 2); 5 = 68° (corresponding to 1, which is $180 - 112$; or co-interior with 3); 8 = 68° (corresponding to 4; alternate exterior to 1).
2. $5x - 10 = 3x + 30$, $x = 20$; 90° each (the transversal is perpendicular).
3. $9x + 45 = 180$, $x = 15$; 105° and 75° .
4. 90° ; the perpendicular transversal theorem.
5. Yes: $95 + 85 = 180$, co-interior converse.
6. $4x + 8 = 6x - 22$, $x = 15$, each 68° ; equal corresponding angles, so parallel.
7. 1 = 54° (corresponding to 5, which equals 6's vertical... 5 = $180 - 54 = 126^\circ$? No: 6 is top-right at the lower crossing, so 5 = 126° , and 1 = 5 = 126° ; 7 = 6 = 54° (vertically opposite).
8. Equal: 2, 6, 7. Supplementary: 1, 4, 5, 8.