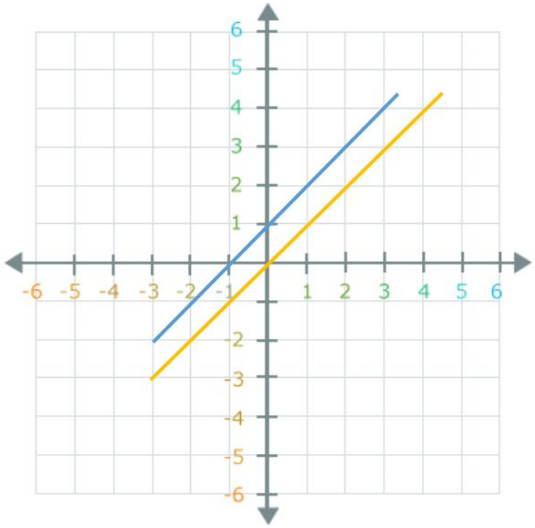
The SAT Initiative

G2 Topic Breakdown
SOL - Geometry

Written by Liam Mulcahy and Nicole D'Onofrio

Topic: *Reasoning, Lines, and Transformations*

Parallel lines have the same slope:



Midpoint Formula

$$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

Distance Formula

$$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

Slope Formula

$$\frac{y_1-y_2}{x_1-x_2}$$

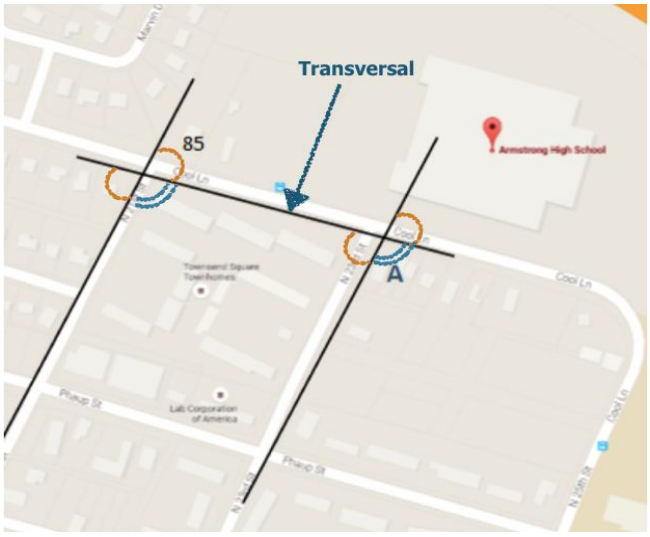
The student will use the ***relationships between angles formed by two lines cut by a transversal****:*

1. Two lines are parallel if they have the same slope

2. Two parallel lines cut by a transversal form distinct angle sets.

If the two lines are parallel, 85 and A will be supplementary (add up to 180)

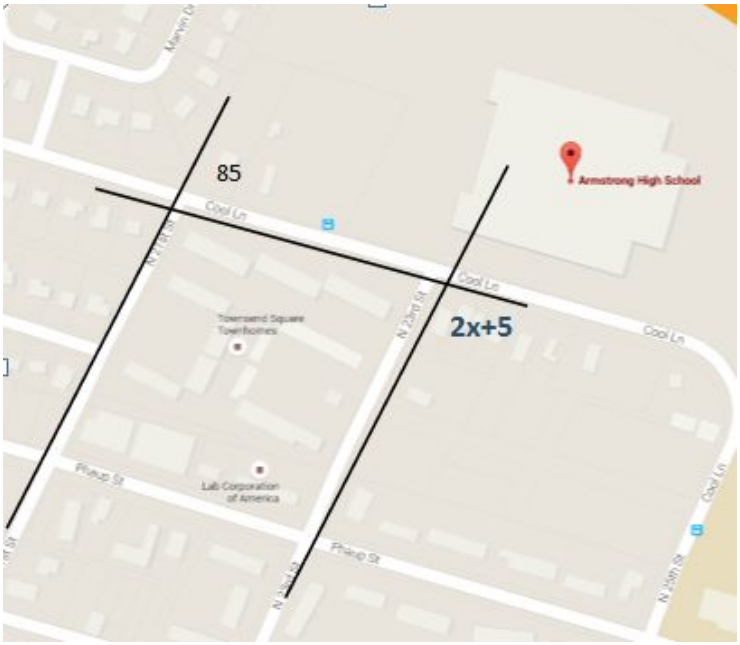
$$A = 180 - 85$$
$$A = 95$$



*Proving that two lines are parallel using **algebraic methods**:*

Prove that 21st and 23rd street are parallel:

(Find what x must be equal to)



$$85 + 2x + 5 = 180$$

$$2x = 90$$

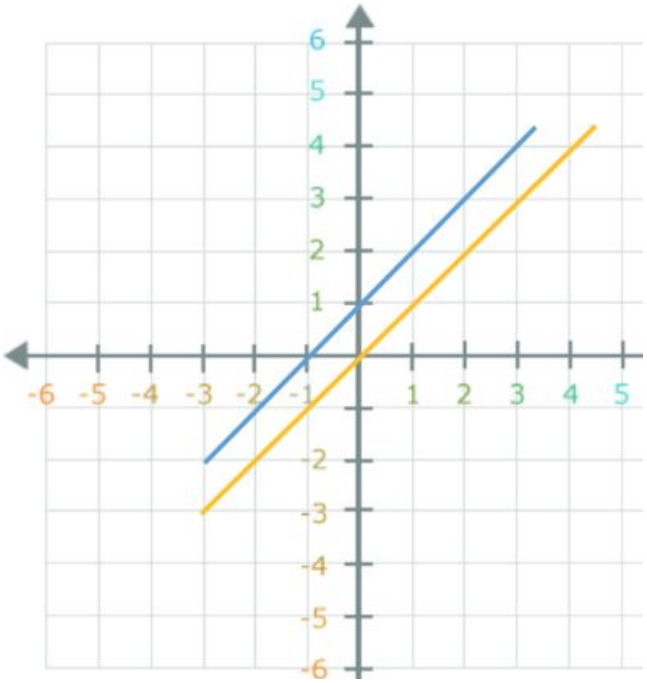
$$x = 45$$

If $x = 45$, that means the two angles are supplementary → This proves the lines are parallel.

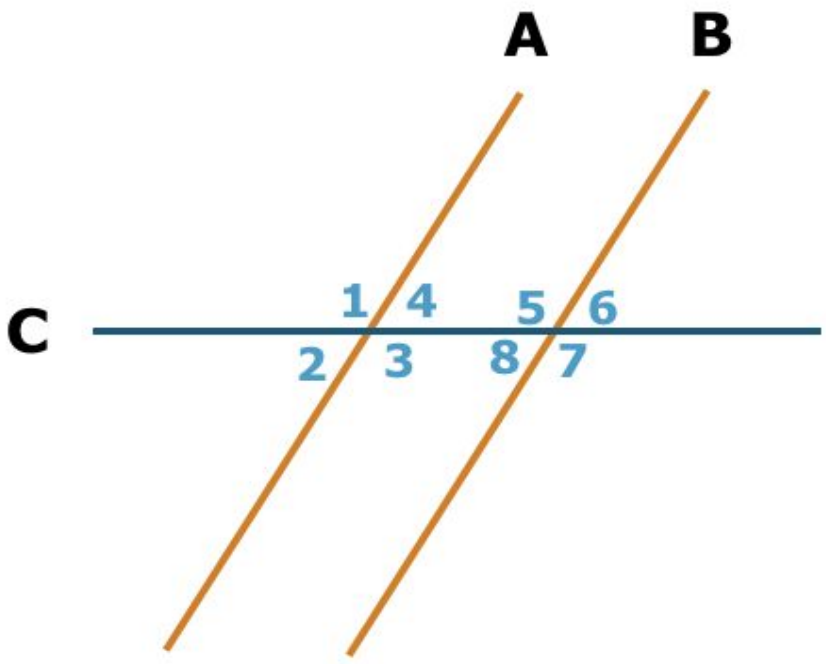
Proving that two lines are parallel using coordinate method:

→ Slope formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$



1. **Pick two points on the first line**
2. **Plug into the slope formula**
3. **m = slope of line 1**
4. **Pick two points on the second line**
5. **Plug into slope formula**
6. **m = slope of line 2**
7. **Same slopes = Parallel**



Congruent Angles →

1-3-5-7 AND 4-2-6-8

Supplementary Angles →

1-6	**2-7**	**4-5**	**3-8**
1-4	**2-3**	**5-6**	**8-7**
1-2	**3-4**	**8-5**	**7-6**
1-4	**2-3**	**5-6**	**8-7**

Corresponding Angles →

1-5 4-6 2-8 3-7

Alternate Interior Angles →

4-8 5-3

Alternate Exterior Angles →

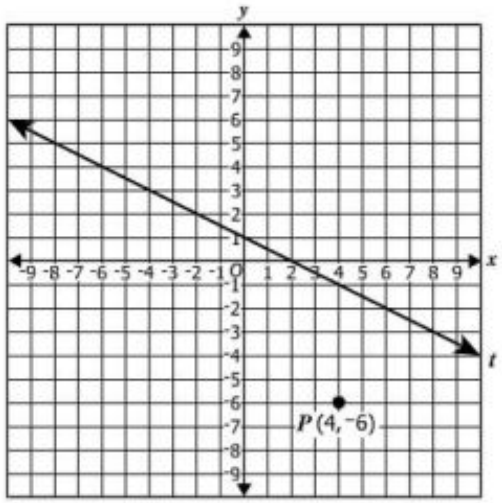
1-7 2-6

Consecutive Interior Angles →

4-5 3-6

Practice Problem (Coordinate Method)

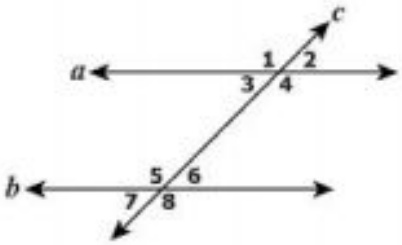
Line t contains the points $(-8, 5)$ and $(8, -3)$. Plot a point other than point P with integral coordinates that is on a line parallel to t and passes through point P.



Practice Problem (Applying Angle Relationships)

The following questions were on released Geometry SOL from 2015 (http://www.doe.virginia.gov/testing/sol/released_tests/2015/gm_released_in_spring_2015.pdf)

In this figure, parallel lines a and b are intersected by line c.

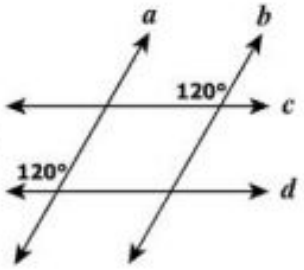


Which pair of angles is NOT supplementary?

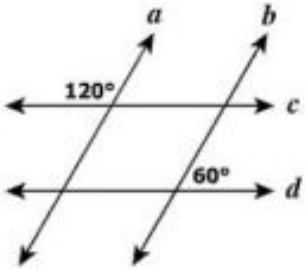
- **A** $\angle 1$ and $\angle 6$
- **B** $\angle 3$ and $\angle 8$
- **C** $\angle 2$ and $\angle 7$
- **D** $\angle 4$ and $\angle 6$

Which diagram shows a pair of angle measures that prove lines a and b are parallel?

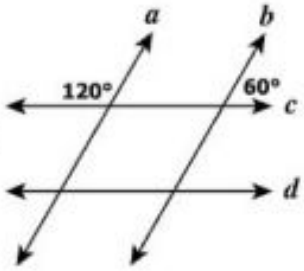
A



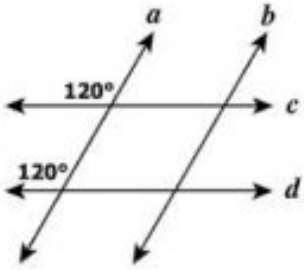
C



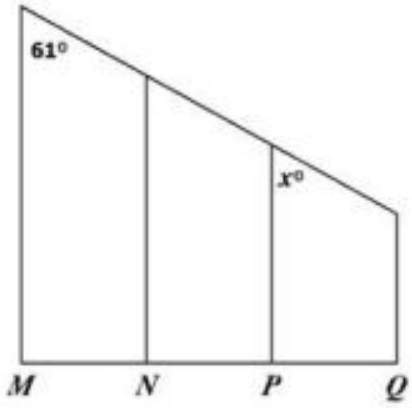
B



D



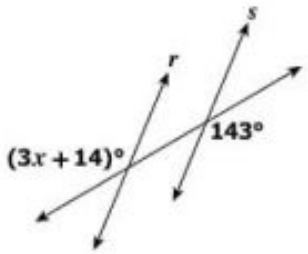
This figure shows parallel stair railings through points M, N, P, and Q.



What is the value of x ?

- **A** 29
- **B** 45
- **C** 61
- **D** 119

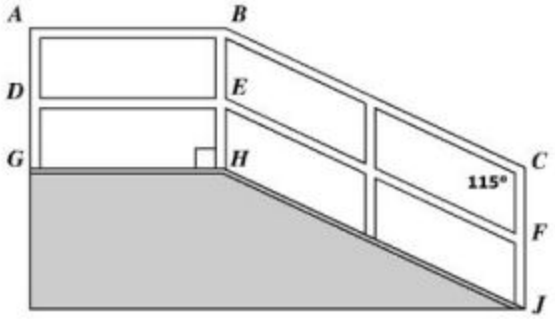
Lines r and s are cut by a transversal.



What value of x proves that $r \parallel s$?

$x =$ [ ]

The figure represents a ramp with handrails. Segments AB and DE are parallel to $\overline{GH}$. Segments BC and EF are parallel to $\overline{HJ}$. Segments AG and BH are parallel to $\overline{CJ}$.

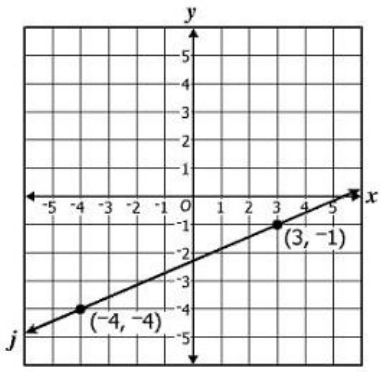


If $m\angle JCB = 115°$, what is $m\angle CBA$?

- **A** 65°
- **B** 90°
- **C** 115°
- **D** 155°

More Practice Problems

The graph of line j is shown.



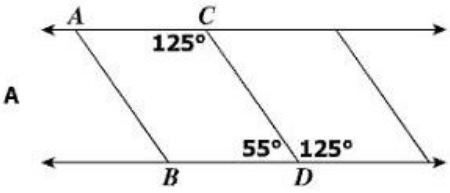
Which ratio represents the slope of a line parallel to line j ?

- A $\frac{3}{7}$
- B $\frac{5}{7}$
- C $\frac{7}{5}$
- D $\frac{7}{3}$

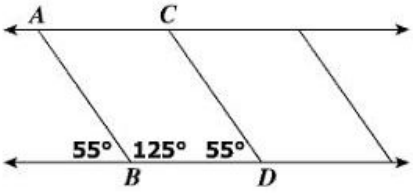
Four lines and four congruent angles are identified in the diagram.

The diagrams represent the stripes used to mark parking spaces on a lot. Based only on the information given, which diagram could be used to prove $\overline{AB} \parallel \overline{CD}$ and $\overline{AC} \parallel \overline{BD}$?

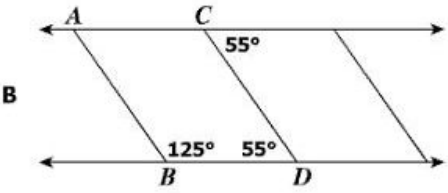
A



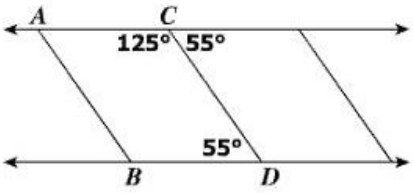
C



B

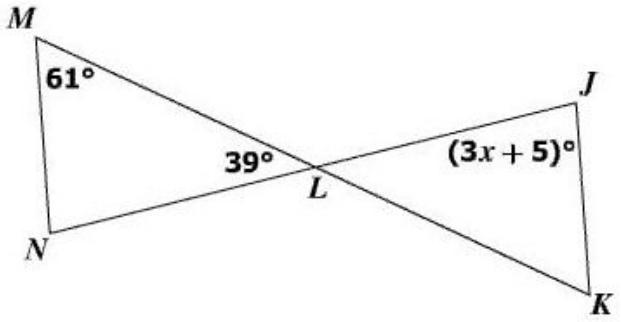


D



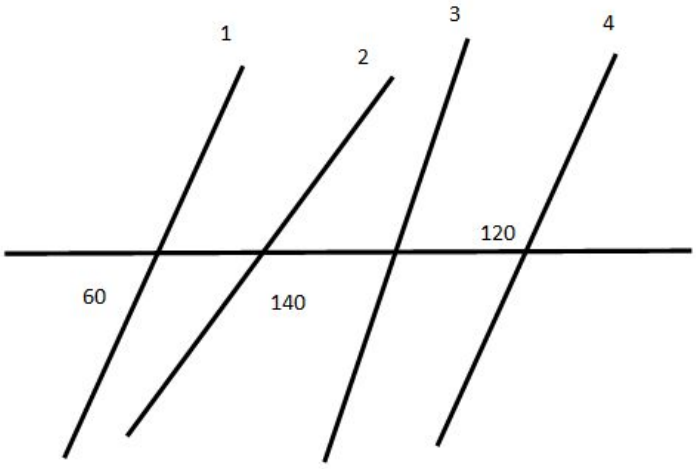
- B Only $p \parallel q$
- C $p \parallel q$ and $m \parallel n$
- D No pair of lines is parallel.

The figure shows $\overline{JN}$ and $\overline{KM}$ intersecting at point L.



What value of x proves $\overline{JK} \parallel \overline{MN}$?

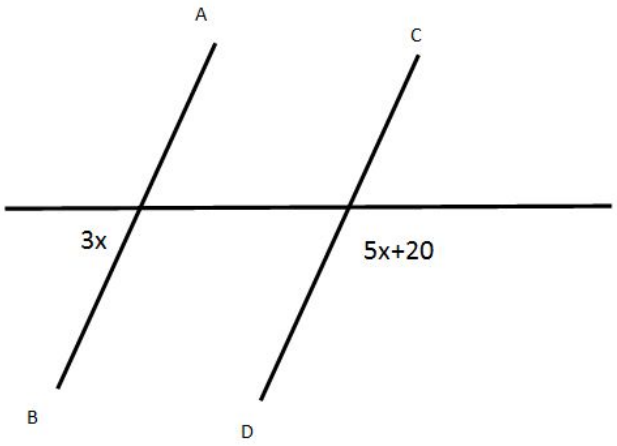
$x =$



Which lines are parallel?

(Look for the pair of supplementary angles)

1 and 4 are parallel because 120 + 60 = 180 degrees

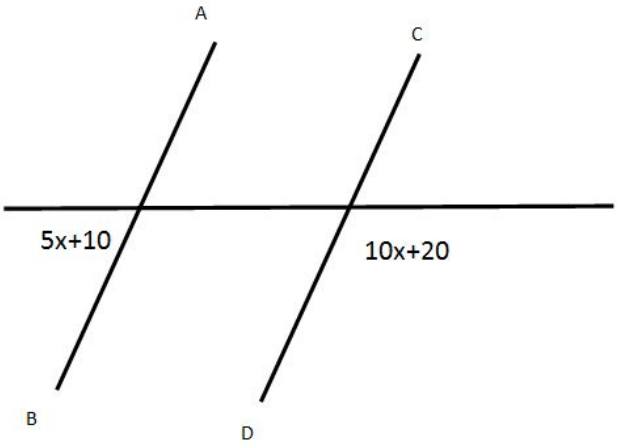


What must x equal for the two lines to be parallel?

(The two angles must be supplementary)

Solve for an x value

3x + 5x + 20 = 180
8x = 160
x = 20



What must x equal for the two lines to be parallel?

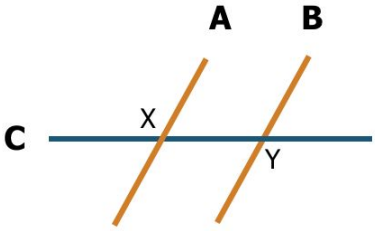
(The two angles must be supplementary)

Solve for an x value

5x+10+10x+20=180
15x+30=180
15x=150
x =10

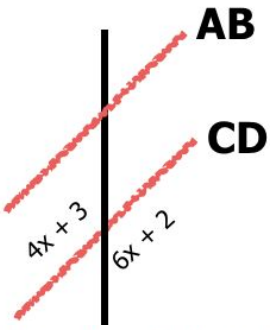
Practice Problems

G.2 Review



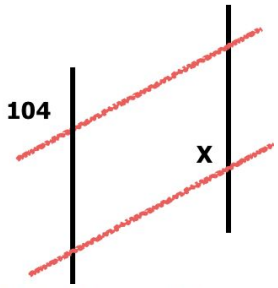
1. If A and B are parallel lines cut by a transversal, which of the following is a way that X and Y are related?

A) Alternate Exterior Angles
B) Congruent Angles
C) Consecutive Interior Angles
D) Complementary Angles



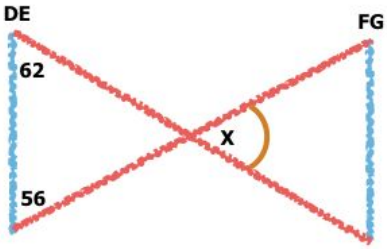
2. Find the value of x that would make line segments AB and CD parallel to each other.

A) 1/2
B) 2
C) 4
D) 5



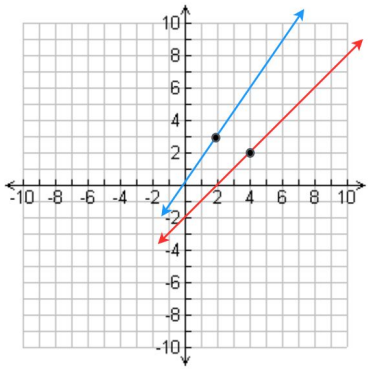
3. The diagram above shows two parallel lines, cut by two parallel transversals. Find the value of X.

A) 45
B) 180
C) 76
D) 104



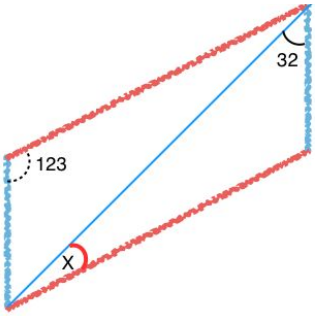
4. Find the value of X that proves Segment DE and Segment FG are parallel lines.

A) 128
B) 62
C) 56
D) 118



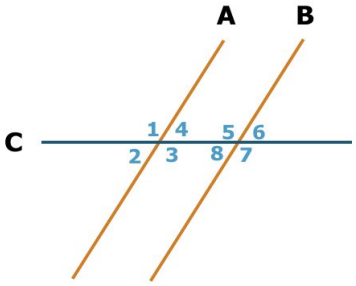
5. Find the distance between the two points above on the graph.

A) √5
B) 2
C) √-1
D) √61



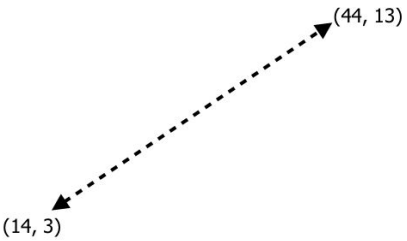
6. Using the figure above, find the value of X that makes the two blue lines parallel to each other.

A) 123
B) 32
C) 25
D) 57



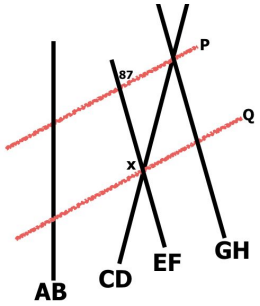
7. Which of the following number pairs represents both congruent and corresponding angles?

A) 5-4
B) 2-8
C) 6-7
D) 2-7



8. Find the midpoint of a line that begins at (14, 3) and ends at (44, 13).

A) (38, 3)
B) (26, 7)
C) (58, 16)
D) (29, 8)



9. Asume that Segment EF is parallel to Segment GH and Segment P is parallel to Segment Q. Find the value of x.

A) 44
B) 87
C) 93
D) 43

Answer Key: Practice Problems

G.2 Geometry

1.	**B**
2.	**A**
3.	**D**
4.	**B**
5.	**A**
6.	**C**
7.	**B**
8.	**D**
9.	**C**