The Family of Lines: One Form, Many Members

A family of graphs shares one form and differs only in its numbers. All lines are the family y = mx + b. b slides the line up or down; m tilts it around the y-intercept. Same m means parallel.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Family of graphs (family of curves)	A group of graphs with the same form, differing only in their numbers.	Name the family first. All straight lines are the family y = mx + b.
Member	One graph in the family, picked out by its own numbers.	y = 2x – 3 is one member of the line family.
Parameter	A number like m or b that picks out one member.	Find the parameters, then say what each one does.
Change b: slide	The line moves straight up or down. Same steepness.	Lines with the same m and different b are parallel.
Change m: tilt	The line turns around its y-intercept. Bigger is steeper, negative falls, 0 is flat.	Same b, different m: same starting point, different tilt.
Parallel	Lines with the same slope. They never meet.	Same m means parallel. More in Unit 4.

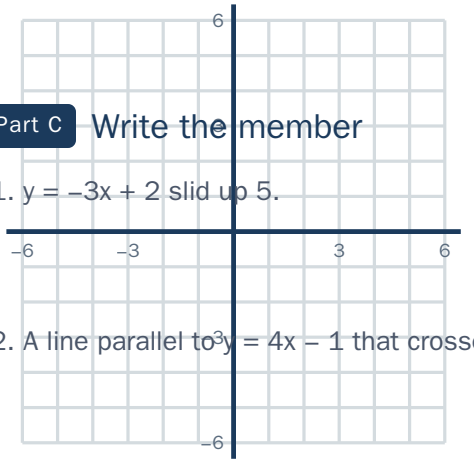
Part A Slide or tilt?

Compare each pair with y = 2x + 3. Write same m or same b, then slid or tilted, and one sentence about what changed.

MEMBER	SAME M OR SAME B?	SLID OR TILTED?	WHAT CHANGED
y = 2x – 1			
y = –x + 3			
y = 2x + 7			
y = 3			
y = 5x + 3			

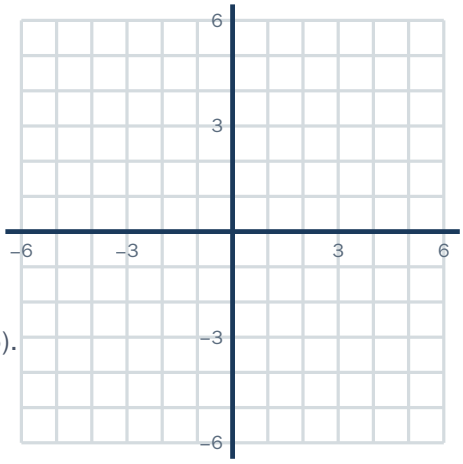
Part B Draw the family

On the left grid, draw y = x – 2, y = x, and y = x + 3 (change b). On the right grid, draw y = 2x + 1, y = 1/2 x + 1, y = 1, and y = –2x + 1 (change m). Label each line.



Part C Write the member

1. y = –3x + 2 slid up 5.



2. A line parallel to y = 4x – 1 that crosses the y-axis at (0, 6).

3. A line with the same y-intercept as y = 4x – 1 that falls gently.

4. The flat member through (0, –4).

5. A member through the origin that climbs steeply.

Part D Match by elimination

y = –3x + 2. Graph A climbs and crosses at 2. Graph B falls steeply and crosses at 2. Graph C falls gently and crosses at 2. Graph D falls steeply and crosses at –2. Which fits? Write the rule that ruled out each of the others.

Part D2 Parallel or not?

Circle the lines parallel to y = –2x + 5, and explain your rule.

y = –2x y = 2x + 5 y = 5 – 2x y = –2x + 5 y = –1/2 x + 5 y = –2x – 9

Part E In your own words

1. What is a family of graphs? Why are all lines one family?

2. What does b do to a line? What does m do?

3. What three questions will you ask about the exponential family and the quadratic family when you meet them?

Part F Exit ticket

1. $y = 3x + 1$ and $y = 3x - 4$: same, different, and what the difference does.

2. Write a member that crosses the y-axis at $(0, -2)$ and falls steeply.

Answer key

Part A. $y = 2x - 1$: same m, slid down 4. $y = -x + 3$: same b, tilted to fall. $y = 2x + 7$: same m, slid up 4. $y = 3$: same b, tilted flat ($m = 0$). $y = 5x + 3$: same b, tilted steeper.

Part B. Left: three parallel lines at 45 degrees crossing the y-axis at –2, 0, 3. Right: four lines fanning out from (0, 1): steep climb, gentle climb, flat, steep fall.

Part C. 1. $y = -3x + 7$. 2. $y = 4x + 6$. 3. Any $y = mx - 1$ with m between –1 and 0, e.g. $y = -1/3\ x - 1$. 4. $y = -4$. 5. Any $y = mx$ with m greater than 1, e.g. $y = 4x$.

Part D. B. A goes the wrong way (m is negative), C is too gentle (size of m is 3), D crosses in the wrong place (b is 2).

Part D2. Parallel: $y = -2x$, $y = 5 - 2x$, $y = -2x - 9$ (same $m = -2$). Not: $y = 2x + 5$ (climbs), $y = -1/2\ x + 5$ (different steepness). $y = -2x + 5$ is the same line.

Part E. 1. Same form, different numbers; all lines are $y = mx + b$. 2. b slides, m tilts. 3. What family? What are its numbers? What does each number do?

Part F. 1. Same m (parallel), different b: slid down 5. 2. e.g. $y = -3x - 2$.