2.2 – Find Slope and Rate of Change

$$\text{Slope} = m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{rise}{run}$$

Example 1 A skateboard ramp has a rise of 15 inches and a run of 54 inches. What is its slope?

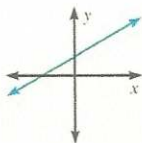$$m = \frac{rise}{run} = \frac{15 \, in}{54 \, in} = \boxed{\frac{5}{18}}$$

Example 2 What is the slope of the line passing through the points (-1,3) and (2,-1)?

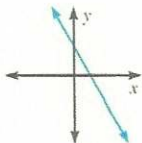$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1-3}{2-(-1)} = \boxed{\frac{-4}{3}}$$

$$x_1 = -1 \qquad x_2 = 2$$
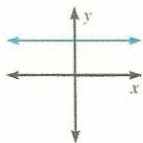$$y_1 = 3 \qquad y_2 = -1$$

Classification of Lines by Slope

The slope of a line indicates whether the line rises from left to right, falls from left to right, is horizontal, or is vertical.
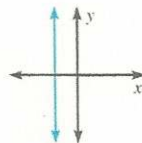

Positive slope	Negative slope	Zero slope	Undefined slope
Rises from left to right	Falls from left to right	Horizontal	Vertical

Example 3 Without graphing, tell whether the line through the given points *rises*, *falls*, is *horizontal*, or is *vertical*.

a. (-5,1), (3,1)   b. (-6,0), (2,-4)   c. (-1,3), (5,8)   d. (4,6), (4,-1)

a) $m = \frac{1-1}{3-(-5)} = \frac{0}{8}$
horizontal

b) $m = \frac{-4-0}{2-(-6)} = \frac{-4}{8} = -\frac{1}{2}$
falls

c) $m = \frac{8-3}{5-(-1)} = \frac{5}{6}$
rises

d) $m = \frac{-1-6}{4-4} = \frac{-7}{0} = UND$

vertical

Parallel and Perpendicular Lines

Parallel $\quad m_1 = m_2 \quad$ same slope

Perpendicular $\quad m_1 = -\dfrac{1}{m_2} \quad$ slopes are opposite reciprocals

Example 4 Tell whether the lines are *parallel*, *perpendicular*, or *neither*

a. Line 1: through (-2,2) and (0,-1)
   Line 2: through (-4,-1) and (2,3)

b. Line 1: through (1,2) and (4,-3)
   Line 2: through (-4,3) and (-1,-2)

Line 1: $m = \dfrac{-1-2}{0-(-2)} = \dfrac{-3}{2}$

Line 2: $m = \dfrac{3-(-1)}{2-(-4)} = \dfrac{4}{6} = \dfrac{2}{3}$

Perpendicular

Line 1: $m = \dfrac{-3-2}{4-1} = \dfrac{-5}{3}$

Line 2: $m = \dfrac{-2-3}{-1-(-4)} = \dfrac{-5}{3}$

Parallel

HW: 3-23 odd

EXAMPLES 2 and 3
on pp. 82–83
for Exs. 3–17

FINDING SLOPE Find the slope of the line passing through the given points. Then tell whether the line *rises*, *falls*, *is horizontal*, or *is vertical*.

3. $(2, -4), (4, -1)$
4. $(8, 9), (-4, 3)$
5. $(5, 1), (8, -4)$
6. $(-3, -2), (3, -2)$
7. $(-1, 4), (1, -4)$
8. $(-6, 5), (-6, -5)$
9. $(-5, -4), (-1, 3)$
10. $(-3, 6), (-7, 3)$
11. $(4, 4), (4, 9)$
12. $(5, 5), (7, 3)$
13. $(0, -3), (4, -3)$
14. $(1, -1), (-1, -4)$

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ERROR ANALYSIS Describe and correct the error in finding the slope of the line passing through the given points.

15.
$(-4, -3), (2, -1)$
$m = \dfrac{-1-(-3)}{-4-2} = -\dfrac{1}{3}$ ✗

16.
$(-1, 4), (5, 1)$
$m = \dfrac{5-(-1)}{1-4} = -2$ ✗

17. ★ **MULTIPLE CHOICE** What is true about the line through $(2, -4)$ and $(5, 1)$?

Ⓐ It rises from left to right.
Ⓑ It falls from left to right.
Ⓒ It is horizontal.
Ⓓ It is vertical.

EXAMPLE 4
on p. 84
for Exs. 18–23

CLASSIFYING LINES Tell whether the lines are *parallel*, *perpendicular*, or *neither*.

18. Line 1: through $(3, -1)$ and $(6, -4)$
    Line 2: through $(-4, 5)$ and $(-2, 7)$
19. Line 1: through $(1, 5)$ and $(3, -2)$
    Line 2: through $(-3, 2)$ and $(4, 0)$
20. Line 1: through $(-1, 4)$ and $(2, 5)$
    Line 2: through $(-6, 2)$ and $(0, 4)$
21. Line 1: through $(5, 8)$ and $(7, 2)$
    Line 2: through $(-7, -2)$ and $(-4, -1)$
22. Line 1: through $(-3, 2)$ and $(5, 0)$
    Line 2: through $(-1, -4)$ and $(3, -3)$
23. Line 1: through $(1, -4)$ and $(4, -2)$
    Line 2: through $(8, 1)$ and $(14, 5)$