LESSON PLAN

Course: Grade 12 U Advanced Functions **Lesson: 6 - 1**

Unit/Chapter: Other Function Types **Topic: Linear Functions Review**

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 note: **Linear Functions Review**

Recall the important formulas:

for slope, $m = \frac{y_2 - y_2}{x_2 - x_1}$, slope-point equation of a line, $y - y_1 = m(x - x_1)$

two point equation of a line, $y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$

and the important ideas for slopes of parallel and perpendicular lines.

* parallel lines have equal slopes and perpendicular lines have slopes that are negative reciprocals

Also, recall the basic form for the equation of a horizontal and vertical line.

* all horizontal lines have the basic form $y = b$ with slope of zero and y intercept at *b*
* all vertical lines have the form $x = a$ with a slope that is undefined and x intercept at *a*

example)

Find the equation of a line that is perpendicular to the line $5x - 2y + 10 = 0$ through the point $(-3, 4)$.

$5x - 2y + 10 = 0$

$-2y = -5x - 10$

$y = \frac{-5x - 10}{-2}$

$y = \frac{5}{2}x + 5$

Therefore, the slope of this line is $\frac{5}{2}$ and the perpendicular slope of this line is $\frac{-2}{5}$.

Therefore, the equation of the line perpendicular to the original through the point $(-3, 4)$ is:

$$y-4=\frac{-2}{5}\left(x-\left(-3\right)\right)$$

$$y-4=\frac{-2}{5}x-\frac{6}{5}$$

$$y=\frac{-2}{5}x-\frac{6}{5}+4$$

$$y=\frac{-2}{5}x-\frac{6}{5}+\frac{20}{5}$$

$$y=\frac{-2}{5}x+\frac{14}{5}$$

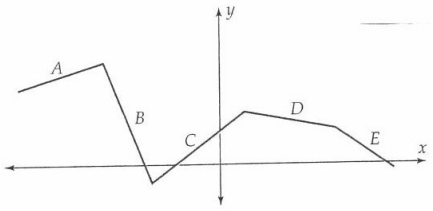
$$5y=-2x+14$$

$$2x+5y-14=0$$

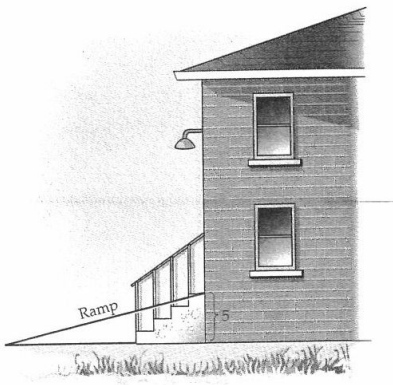
- ***homework assignment:*** **HRW** exercise 1.4 p. 40 – 41

Exercises 1.4

1. For which of the line segments in the figure is the slope
   a. largest?
   b. smallest?
   c. largest in absolute value?
   d. closest to zero?



2. The doorsill of a campus building is 5 ft above ground level. To allow wheelchair access, the steps in front of the door are to be replaced by a straight ramp with constant slope $\frac{1}{12}$, as shown in the figure. How long must the ramp be? [The answer is not 60 ft.]



In Exercises 3–6, find the slope and y-intercept of the line whose equation is given.

3. $2x - y + 5 = 0$
4. $3x + 4y = 7$
5. $3(x - 2) + y = 7 - 6(y + 4)$
6. $2(y - 3) + (x - 6) = 4(x + 1) - 2$

In Exercises 7–10, find the slope of the line through the given points.

7. $(1, 2); (3, 7)$
8. $(-1, -2); (2, -1)$
9. $\left(\frac{1}{4}, 0\right); \left(\frac{3}{4}, 2\right)$
10. $(\sqrt{2}, -1); (2, -9)$

In Exercises 11–14, find a number t such that the line passing through the two given points has slope -2.

11. $(0, t); (9, 4)$
12. $(1, t); (-3, 5)$
13. $(t + 1, 5); (6, -3t + 7)$
14. $(t, t); (5, 9)$

15. Let L be a nonvertical straight line through the origin. L intersects the vertical line through $(1, 0)$ at a point P. Show that the second coordinate of P is the slope of L.

16. On one graph, sketch five line segments, not all meeting at a single point, whose slopes are five different positive numbers.

In Exercises 17–20, find the equation of the line with slope m that passes through the given point.

17. $m = 1; (3, 5)$
18. $m = 2; (-2, 1)$
19. $m = -1; (6, 2)$
20. $m = 0; (-4, -5)$

In Exercises 21–24, find the equation of the line through the given points.

21. $(0, -5)$ and $(-3, -2)$
22. $(4, 3)$ and $(2, -1)$
23. $\left(\frac{4}{3}, \frac{2}{3}\right)$ and $\left(\frac{1}{3}, 3\right)$
24. $(6, 7)$ and $(6, 15)$

In Exercises 25–28, determine whether the line through P and Q is parallel or perpendicular to the line through R and S, or neither.

25. $P = (2, 5), Q = (-1, -1)$ and $R = (4, 2), S = (6, 1)$
26. $P = \left(0, \frac{3}{2}\right), Q = (1, 1)$ and $R = (2, 7), S = (3, 9)$
27. $P = \left(-3, \frac{1}{3}\right), Q = (1, -1)$ and $R = (2, 0)$, $S = \left(4, -\frac{2}{3}\right)$
28. $P = (3, 3), Q = (-3, -1)$ and $R = (2, -2), S = (4, -5)$

In Exercises 29–31, determine whether the lines whose equations are given are parallel, perpendicular, or neither.

29. $2x + y - 2 = 0$ and $4x + 2y + 18 = 0$

30. $3x + y - 3 = 0$ and $6x + 2y + 17 = 0$

31. $y = 2x + 4$ and $0.5x + y = -3$

32. Use slopes to show that the points $(-4, 6)$, $(-1, 12)$, and $(-7, 0)$ all lie on the same straight line.

33. Use slopes to determine if $(9, 6)$, $(-1, 2)$, and $(1, -3)$ are the vertices of a right triangle.

34. Use slopes to show that the points $(-5, -2)$ $(-3, 1)$, $(3, 0)$, and $(5, 3)$ are the vertices of a parallelogram.

In Exercises 35–42, find an equation for the line satisfying the given conditions.

35. through $(-2, 1)$ with slope 3

36. y-intercept -7 and slope 1

37. through $(2, 3)$ and parallel to $3x - 2y = 5$

38. through $(1, -2)$ and perpendicular to $y = 2x - 3$

39. x-intercept 5 and y-intercept -5

40. through $(-5, 2)$ and parallel to the line through $(1, 2)$ and $(4, 3)$

41. through $(-1, 3)$ and perpendicular to the line through $(0, 1)$ and $(2, 3)$

42. y-intercept 3 and perpendicular to $2x - y + 6 = 0$

43. Find a real number k such that $(3, -2)$ is on the line $kx - 2y + 7 = 0$.

44. Find a real number k such that the line $3x - ky + 2 = 0$ has y-intercept -3.

45. Write the equation for the given arithmetic sequence in slope-intercept form.

1	2	3	4	5
−2	2	6	10	14

46. Write the equation for the given arithmetic sequence in slope-intercept form.

1	2	3	4	5
10	7	4	1	−2

47. The first three terms of an arithmetic sequence are 7, 1, and -5. Write the sequence's equation in slope-intercept form.

48. For a given arithmetic sequence, the common difference is -3 and $u_1 = 6$. Find the slope and y-intercept of the graph of this sequence.

49. For a given arithmetic sequence, the common difference is 8 and $u_1 = -2$. Find the slope and y-intercept of the graph of this sequence.

50. Let L be a line that is neither vertical nor horizontal and which does not pass through the origin. Show that L is the graph of $\frac{x}{a} + \frac{y}{b} = 1$, where a is the x-intercept and b is the y-intercept of L.

51. Let A, B, C, and D be nonzero real numbers. Show that the lines $Ax + By + C = 0$ and $Ax + By + D = 0$ are parallel.

52. Sales of a software company increased linearly from \$120,000 in 1996 to \$180,000 in 1999
- **a.** Find an equation that expresses the sales y in year x (where $x = 0$ corresponds to 1996).
- **b.** Estimate the sales in 2001.

53. According to the Bureau of Debt of the U.S. Department of the Treasury, the national debt was about 2125 billion dollars in 1986 and about 5225 billion dollars in 1996.
- **a.** Find a linear equation that approximates the national debt y (in billions of dollars) in year x (with $x = 0$ corresponding to 1986).
- **b.** Use the equation of part **a** to estimate the national debt in 1991 and 2000. [For comparison purposes, the actual national debt in 1991 was 3665.3 billion dollars.]

54. At sea level, water boils at 212° F. At a height of 1100 ft, water boils at 210° F. The relationship between boiling point and height is linear.
- **a.** Find an equation that gives the boiling point y of water at a height of x feet.

Find the boiling point of water in each of the following cities (whose altitudes are given).
- **b.** Cincinnati, OH (550 ft)
- **c.** Springfield, MO (1300 ft)
- **d.** Billings, MT (3120 ft)
- **e.** Flagstaff, AZ (6900 ft)