

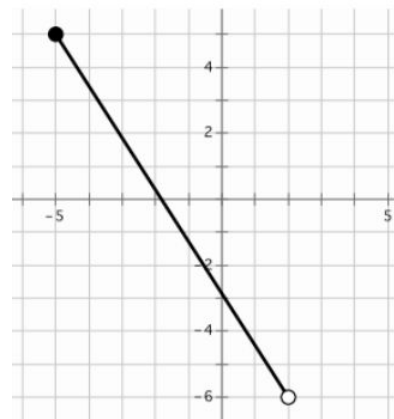
## IM2 Problem Set 4.6 - Linear Relations

**BIG PICTURE**  
of this UNIT:

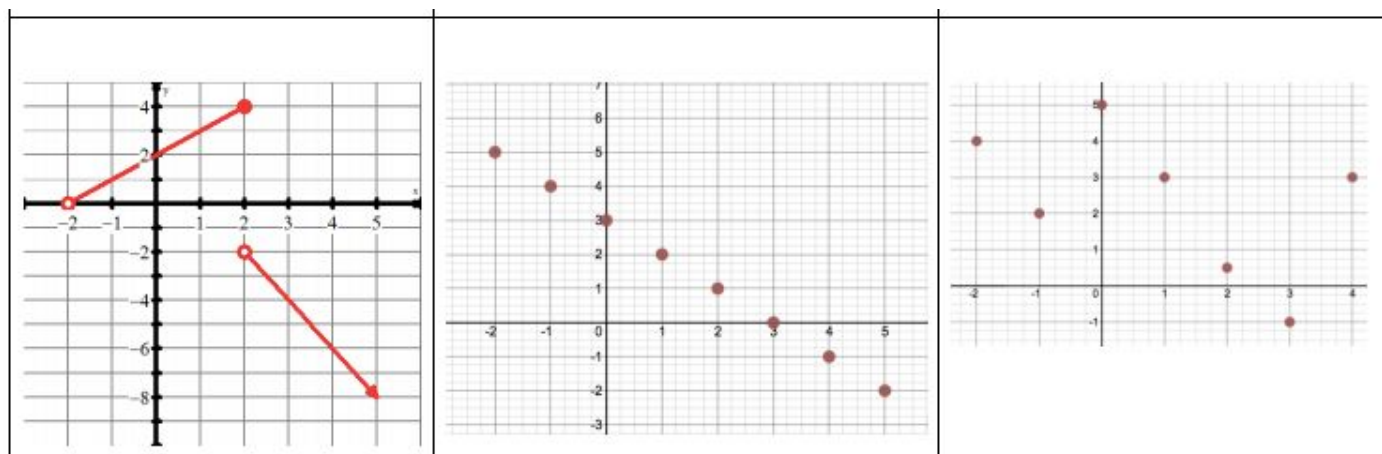
- What is meant by the term **FUNCTIONS** and how do we work with them?
- mastery with working with basics & applications of linear functions
- mastery with working with basics & applications of linear systems
- understanding basics of function concepts and apply them to lines & linear systems

### Part 1 - Skills/Concepts Review

1. Given a graph of this linear function:
  - a. express the linear equation in standard form;
  - b. determine the domain and range of this linear function.



2. State the domain and range of the following graphs. You **MUST** use set notation (for practice!!) and may use interval notation.



3. The following table shows the temperatures at various times of the day.

<b>Time (p.m.)</b>	2	3	4	5	6	7
<b>Temperature (°C)</b>	-1	2	2.5	4	6.5	9

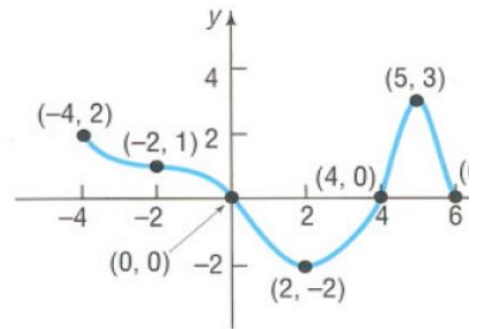
- a. Construct a scatter plot for the data.
- b. Sketch the line of best fit.
- c. Determine an equation for the line of best fit.
- d. Predict the temperature at 5:30 pm. How confident are you about your prediction? Explain your reasoning.
- e. Predict the time when the temperature is 8°C. How confident are you about your prediction? Explain your reasoning.
- f. Predict the temperature at 09:00 am. How confident are you about your prediction? Explain your reasoning.

4. Determine the value of the unknown in the following problems:

- Find  $A$  if the graph of the equation  $Ax + 3y = 5$  is parallel to the graph of  $5x - 2y = 4$
- Find  $B$  if the graph of the equation  $3x = By + 2$  is perpendicular to the graph of  $3y = -2x + 4$
- Find  $A$  and  $B$  if the graph of  $Ax + 3y = B$  produces the same line as the graph of  $2x + 6y = 7$

5. A graph of the function  $g$  is given. Use the graph to answer the following questions:

- Evaluate  $g(0)$ ,  $g(6)$ ,  $g(2)$ ,  $g(-2)$
- Is  $g(-1)$  positive or negative?
- For what values of  $x$  is  $g(x) = 0$ ?
- For what values of  $x$  is  $g(x) < 0$ ?
- How often does the line  $y = -1$  intersect  $g$ ? Hence, solve  $g(x) = -1$
- How often does the line  $x = 1$  intersect  $g$ ?
- Solve  $g(x) = 3$ . Solve  $g(x) = -2$ .



## **Part 2 - Skills/Concepts Application Problems**

6. Given the lines  $3x - 2y = k$ :

- Use DESMOS to graph the lines  $3x - 2y = k$  for  $k = 1, 2, 3$  and  $4$ .
- How are the lines related?
- How can you QUICKLY use the graph of  $3x - 2y = 4$  to produce the graph of  $3x - 2y = 20$ ?

7. Let  $f(x) = 3x + 2$  and let  $g(x) = 2x - 9$ .

- Find  $f(3) + g(3)$ ; find  $f(5) + g(5)$  and find  $f(-2) + g(-2)$ .
- Let  $C(x) = f(x) + g(x)$ . Find an expression for  $C(x)$ . Is  $C$  a function?
- Find  $f(3) \times g(3)$ ; find  $f(5) \times g(5)$  and find  $f(-2) \times g(-2)$ .
- Let  $P(x) = f(x) \times g(x)$ . Find an expression for  $P(x)$ . Is  $P$  a function?

8. A line with a slope of 3 intersects a line with a slope of 5 at the point  $(10, 15)$ . What is the distance between the  $x$ -intercepts of these 2 lines?

9. Let  $f(x) = 2x - 6$  and let  $g(x) = 3x - 9$ .

- Find  $f(g(2))$  as well as  $g(f(2))$  as well as  $f(g(x))$ .
- Let  $h(x) = 3x + 10$ . For what value of  $x$  does  $h(h(x)) = x$ ?

10. The amount of fuel a hybrid car uses is measured at various speeds as shown in the table included.

Speed (km/h)	3	8	11	16	21	26	32	40	50	60	64	67	71	80	90	100	110
Fuel Consumption (L/100 km)	14.9	5.3	4.7	3.8	3.5	3.3	3.2	3.1	3.1	3.1	3.1	3.8	3.9	4.1	4.4	4.9	5.3

- Is the data discrete or continuous?
- What is the independent variable? The dependent variable?
- Use your TI-84 to draw a scatter plot of the data.
- Describe any pattern you see.
- Does this pattern you described in Q(d) seem reasonable? Explain.
- What speed should you drive to minimize fuel consumption?
- Suggest a reasonable domain and range for this relation. Explain your reasoning.

### Part 3 - Extension Problems

11. A freight delivery company charges \$4/kg for any order less than or equal to 100 kg and \$3.50/kg for any order of more than 100 kg.

- Why must this relation be a function?
- What is the domain of this function? What is the range?
- What would the delivery charge of a 50 kg parcel be? Of a 100 kg parcel? Of a 150 kg parcel?
- Provide a sketch for this function.
- Write an equation that models the delivery charges as a function of the parcel's weight.

12. A car parking lot charges \$10 for every hour (**or part of an hour**) for parking. To help you to sketch a graph of the parking charges as a function of the parking time,  $y = C(t)$ , answer these questions:

- Evaluate  $C(1)$ ,  $C(2)$ ,  $C(3)$ ,  $C(4)$  and  $C(5)$ . Prepare a sketch of the graph of the parking costs.
- Now evaluate  $C(0.5)$ ,  $C(1.5)$ ,  $C(2.5)$ ,  $C(3.5)$  and  $C(4.5)$  and use this additional information to (possibly) rethink your sketch of the graph of the parking costs.

### HOMEWORK PROBLEMS:

- Function Notation: Nelson 11, Chap 1.2, p22, Q9,11,12
- Linear Relations: Nelson 10, Chap 1.2, p19, Q4,6,7