

## IM2 Problem Set 5.3 - Linear Functions

---

|                              |  |
|------------------------------|--|
| BIG PICTURE<br>of this UNIT: | <ul style="list-style-type: none"><li>• What is meant by the term FUNCTIONS and how do we work with them?</li><li>• mastery with working with basics &amp; applications of linear functions</li><li>• mastery with working with basics &amp; applications of linear systems</li><li>• understanding basics of function concepts and apply them to lines &amp; linear systems</li></ul> |
|------------------------------|--|

### Part 1 - Skills/Concepts Review

1. A relation is defined by the following description: *To “create/generate” a new value, a “starting” number is reduced by 2 and then this result is halved.* The CONDITION on the “starting” number is that it must be a real number between and excluding -4 and 8.
  - a. Use the starting numbers of  $x = -4, -3, -2, -1, \dots, 6, 7, 8$  to create a table of values for this relation.
  - b. Create an equation for this relation and then graph this relation.
2. You are given two linear functions:  $f(x) = 5x - 1$  and  $g(x) = -2x + 20$ .
  - a. State 2 ordered pairs that satisfy each function and one ordered pair that does not.
  - b. Is there an ordered pair that satisfies BOTH functions? If so, how do you know that there is and what is this ordered pair? If not, how do you know that their isn't?
3. Given the following equations:
  - a. if  $g(x) = 4 - 3x$ , solve the equation  $g(x) = 13$
  - b. if  $h(x) = \frac{2}{3}x + 6$ , solve  $h(x) = 10$
4. Determine the equation of a line that passes through the points A(5,-2) and B(-1,-6). Write the equation in all three forms.

### Part 2 - Skills/Concepts Application Problems

5. Write the equation of a line that is:
  - a. parallel to  $2x + 3y = 6$  and passes through the point (5,-1)
  - b. perpendicular to  $2x - 5y - 9 = 0$  and has a zero at -3.

6. Leah's monthly earnings are modeled by the following relation: she earns \$1200/month plus a 3.5% sales commission.
- Create an equation she can use to determine what her monthly earnings should be.
  - Last month, Leah had \$96,174 in monthly sales. What should her monthly earnings be?
  - If her monthly earnings need to be \$6,000 per month, what should her monthly sales be?
  - Graph this relation on your calculator and record your window settings.

7. Changing forms of linear functions:

- Change the equation  $y - 4 = \frac{1}{3}(x + 2)$  into slope-intercept form and into standard form. Graph this function on a calculator.
- Change the equation  $4x - 2y - 12 = 0$  into slope-intercept form and into slope-point form. Graph this linear function on a calculator.
- At what point do the two linear functions intersect?

8. Judy is considering two sales positions. SAM'S store offers \$1600/month plus 2.5% in commission in sales and CAROL'S store offers \$1000/month plus 5% in commission on sales. In past sales experiences, Judy usually has sales around \$15,000 per month.

- Represent the offer from SAM'S store as an equation so Judy can predict what her monthly earnings might be.
- Which offer should Judy take? Explain your reasoning.

9. Given the linear function  $3x + 4y = 24$ :

- Rewrite this linear equation in function form ( $f(x) = \dots\dots\dots$  )
- Determine the following values and then explain what is happening ....

i.  $\frac{f(3) - f(1)}{3 - 1}$

ii.  $\frac{f(4) - f(1)}{4 - 1}$

10. Patrick has saved \$600 and will use this money to buy British pounds as well as euros for a school trip. He knows that one British pound costs \$2 and that one euro costs \$1.50.

- Determine 3 ordered pairs (3 points) that shows how many pounds and euros Patrick can buy.
- Explain why Mr. S writes the equation  $2x + 1.5y = 600$  to model this relation.
- Explain WHY this relation must be a function.

11. Maureen pays a \$350 registration fee as well as a \$85 monthly fee to belong to a fitness club. Lia belongs to another club that has a higher registration fee but a lower monthly fee. After 5 months, both Lia and Maureen have paid the same amount of \$775. Determine the possible fees at Lia's club.
12. Yasser is renting a car. Zeno Car Rental charges an initial fee of \$45 for the rental as well as \$0.10 per kilometer driven. Erdos charges an initial fee of \$35 for the rental of the same car as well as \$0.25 per kilometer driven.
- The rental fees from both companies can be modeled using a linear function. Write equations to represent the cost of renting from Zeno and the cost of renting from Erdos.
  - From which company should Yasser rent the car? Show your supporting mathematical evidence

### Part 3 - Extension Problems

13. 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.
14. 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.