Introduction to Functions

1. Writing function formulas:

   a) Let f be a function that triples its input, and then subtracts 4. Write a formula for this function.

   b) Let b be a function that squares its input, then divides by two, and then adds 1. Write a formula for this function.

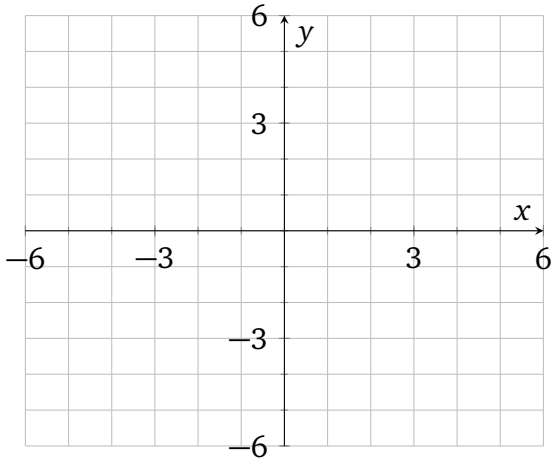
   c) Film director Jim Jarmusch was born on today's date, January 22, 1953. Let a be a function that finds his age on January 22 in year x. Write a formula for this function. Hint: you may want to calculate his age in years like 2000, 2010, and 2020 first to get a feel for what the formula will look like.

   d) Suppose that income tax is collected at a flat rate of 15%. Let t be the function that finds what your income tax amount is based on what your annual income is. Write a formula for this function.

2. Let f be a function that triples its input, and then subtracts 4.

   (a) Give a tabular representation of f. Use at least five input values.

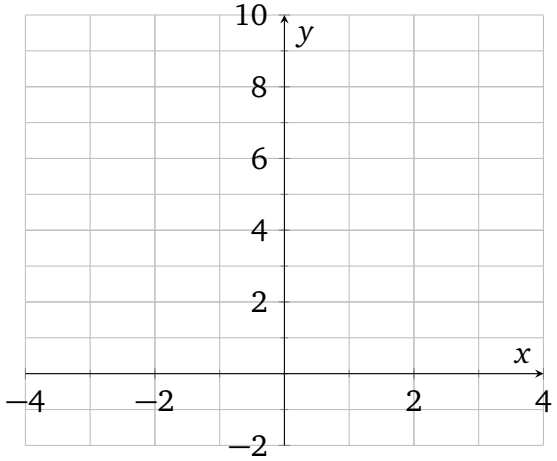
   (b) Give a graphical representation of f. Make your graph reasonably neat.



3. Let b be a function that squares its input, then divides by two, and then adds one.

   (a) Give a tabular representation of b. Use at least five input values.

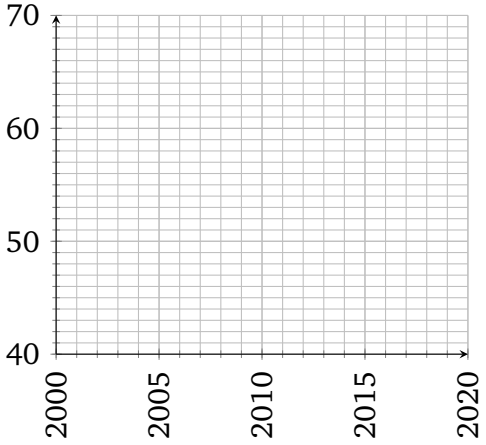
   (b) Give a graphical representation of b. Make your graph reasonably neat.



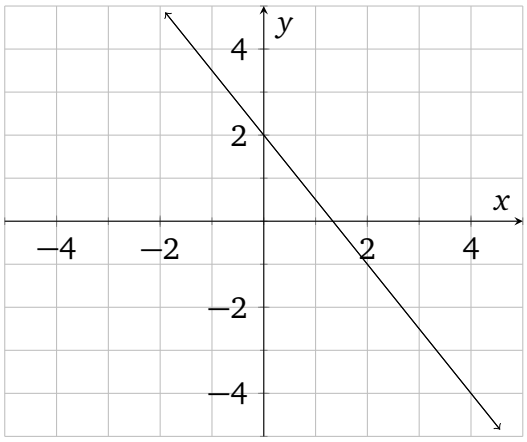
4. Film director Jim Jarmusch was born on today's date, January 22, 1953. Let a be a function that finds his age on January 22 in year x.

   (a) Give a tabular representation of a. Use at least five input values.

   (b) Give a graphical representation of a. Make your graph reasonably neat.



5. Here is the graph of a function G.



a) Find $G(0)$

b) Find $G(-2)$

c) Find $G(4)$

d) If $G(x) = -1$, then what was x?

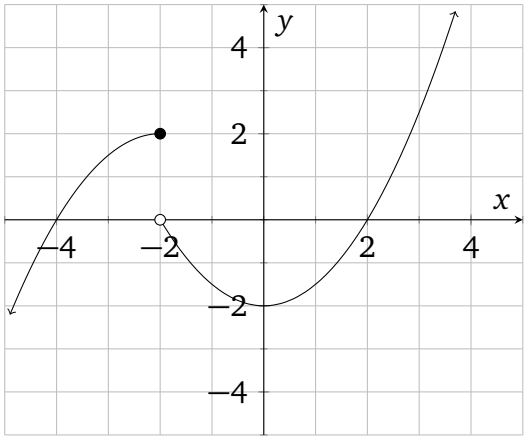
e) Basic Algebra Review: what is the equation of this line in slope-intercept form?

f) Give a *formula* representation of G. (Use function notation to write G's formula.)

g) Give a *tabular* representation of G.

h) Give a *verbal* representation of G. (See the intro to exercise 2 for what this might be like.)

6. Here is the graph of a function P.



a) Find $P(0)$

b) Find $P(2)$

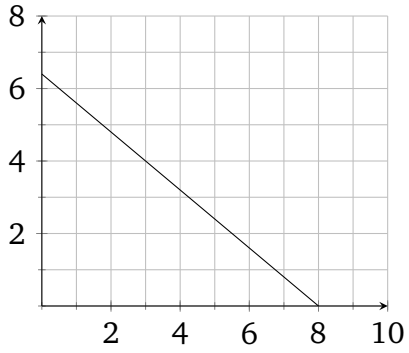
c) Find $P(-2)$

d) Solve $P(x) = 1$

e) Solve $P(x) = 0$

f) Solve $P(x) = -1$

7. Jonah is biking home from a trip to the grocery store. At time t (in minutes since leaving), $d(t)$ is the remaining distance (in km) to home.



a) Label the axes of this graph appropriately. Axes should always have an appropriate variable for their label. If there is context to the problem, the label should also communicate the units of measurement.

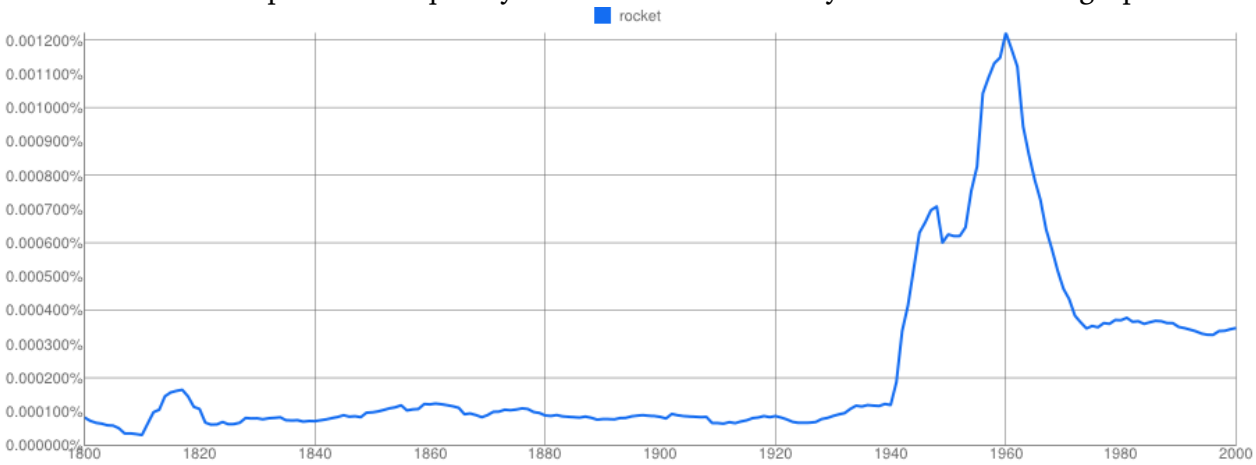
b) Find $d(8)$. Write a complete sentence explaining what the numbers mean.

c) How far away from Jonah's home is the grocery store?

d) Solve $d(t) = 3$. Write a complete sentence explaining what the numbers mean.

e) What was Jonah's speed biking home?

8. Google `ngram` provides data on the frequency of word-use in published books. So, out of all words printed in book in a given year, what percentage were a particular word. Let r be the function that outputs the frequency of the word 'rocket' in year t. Here is the graph of r.



(a) What is $r(1940)$? Write a complete sentence explaining what the numbers mean.

(b) There are three peaks in this chart. Express the input-output information at the spikes using function notation. For example, by writing something like $r(1) = 2$.

(c) Do you have knowledge of history that could explain each of the spikes?