

# Study guide for Math 1410 Midterm 1

September 16, 2021

These are the topics you should know for the first midterm.

- (a) Power and radical functions.
- (b) Quadratic functions.
- (c) Linear and constant functions.
- (d) Geometric transformations.
- (e) Domains, ranges, images, preimages.
- (f) Increasing, decreasing, constant, concave up, concave down.
- (g) Rate of change, difference quotients, how to calculate average rate of change.

These are the sorts of questions you should know how to solve for the first midterm.

- (1) Sketch a graph of  $f(x) = 2(x - 1) + 3$ , identifying all  $x$ - and  $y$ -intercepts.
- (2) Find all points where the graphs of  $f$  and  $g$  intersect, where  $f(x) = x^2 - 4x + 3$  and  $g(x) = -2x^2 + x + 3$ .
- (3) Determine the difference quotient for  $f(x) = 2\sqrt{x - 3} + 1$  between two inputs  $a < b$ . What is the average rate of change of  $f(x)$  from 4 to 7?
- (4) Suppose you know that  $f'(x)$  is negative when  $x < 2$ , positive when  $x > 2$ , and 0 when  $x = 2$ . Determine where  $f(x)$  is increasing/decreasing, and identify the  $x$ -coordinate for all maximums or minimums of  $f(x)$ .
- (5) Find the vertex and all intercepts for  $h(t) = -3(t + 2)^2 + 4$ .
- (6) Suppose you know that the image of  $(0, 1)$  under  $G$  is  $[-1, 2)$ . If  $F(y) = 2G(y) - 2$  determine the image of  $(0, 1)$  under  $F$ .
- (7) Find the vertex and any zeroes of  $q(s) = -s^2 + 2s - 4$ , and sketch a graph of  $q$ .
- (8) Identify what geometric transformations were applied to a basic power function  $x^n$  to get  $f(x) = -3(x + 1)^5 - 3$ . Find the intercepts of  $f(x)$  and sketch a graph, identifying the intercepts and inflection point.
- (9) Find the image of  $[0, 2]$  under the function  $a(x) = 2x^3 - 2$ .
- (10) Find the preimage of  $(-2, 2)$  under the function  $b(t) = t^2 - 4$ .
- (11) Suppose  $f(x) = 2x^2$  and  $g(x) = \sqrt{x + 1}$ . Determine  $(f \circ g)(x)$ .
- (12) Suppose  $f(x) = 3x - 1$  and  $g(x) = 2x + 2$ . Determine  $(f + g)(x)$  and  $(f \cdot g)(x)$ .

Another good study source is the in-class worksheets, which can be found on the public course website.