MAT170 Review Problems for Exam 1

A. Difference Quotient – Section 1.3

Find and simplify the difference quotient, $\dfrac{f(x+h)-f(x)}{h}$, $h \neq 0$ for the following functions:

1. $f(x) = \dfrac{1}{3x}$ 2. $f(x) = -x^2 - 3x + 1$ 3. $f(x) = 3x^2 - 5x + 2$ 4. $f(x) = x^3 + 7x$

B. Inverse Functions – Section 1.8

Find the inverse of the following one-to-one functions:

1. $f(x) = \dfrac{x-3}{x+1}$ 2. $f(x) = 7 - 3x$ 3. $f(x) = x^3 - 1$ 4. $f(x) = \dfrac{x}{2x-3}$

5. For question 1 find the domain and range for $f(x)$ and $f^{-1}(x)$.

C. Complex Numbers – Section 2.1

Algebraically simplify and write your answer in standard form, $a + bi$, for the following:

1. $\dfrac{3i(2-4i)}{4+3i}$ 2. $\dfrac{-2i(5+3i)}{3+i}$ 3. $\dfrac{8-5i}{3+6i}$

D. Quadratic Functions – Section 2.2

Given the following quadratic functions, rewrite the functions in standard form, $f(x) = a(x-h)^2 + k$, by completing the square:

1. $f(x) = 3x^2 - 12x + 1$
2. $f(x) = -2x^2 - 16x - 40$
3. $f(x) = -3x^2 + 12x$

E. Transformation of Functions – Section 1.6

Begin by graphing the standard cubic function, $f(x) = x^3$.

1. After performing the following transformations, find the new function $g(x)$;
   - Shift downward 23 units and shift 13 units to the right
   - Reflect across x-axis, shift upward 5 units and shift 6 units to the left.
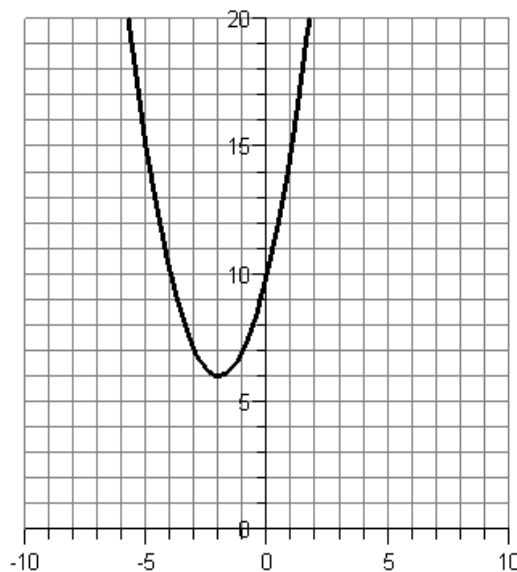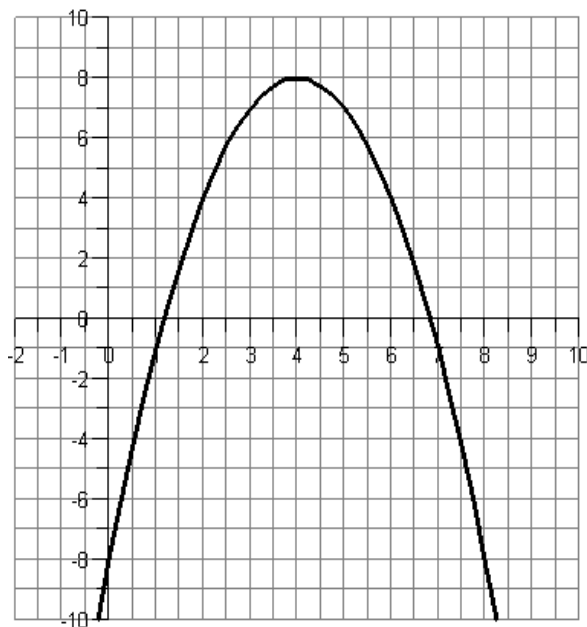
2. Use transformations of the original graph to graph the given function, describe the transformations in words;
   - $g(x) = -(x-1)^3$
   - $h(x) = x^3 - 2$

3. Using the graphs below, write the formulas for the transformations of $f(x) = x^2$.

a.   b.

F. Combinations and Compositions of Functions – Section 1.7

Given the functions:

1. $f(x) = \sqrt{x-3}$ and $g(x) = \dfrac{1}{x}$

2. $f(x) = \dfrac{x}{x+2}$ and $g(x) = 3x - 2$

3. $f(x) = 3x^2 + x - 1$ and $g(x) = 3x - 2$

Use f and g from 1, 2, and 3 to find the following:

a) $(f - g)(x)$ b) $(g \circ f)(x)$

c) $(f \circ g)(x)$ d) $(g \circ g)(x)$

G. Decomposing Functions – Section 1.7

Express the given function h as a composition of two functions f and g so that $h(x) = (f \circ g)(x)$:

1. $h(x) = (3x^2 - 7x + 1)^6$

2. $h(x) = \sqrt[5]{5x - 23}$

H. Increasing/Decreasing – Section 1.3

Graph the following to determine the open intervals where the following functions are increasing and where they are decreasing:

1. $f(x) = \dfrac{x^3}{3} - 4x + 5$ 2. $f(x) = -x^2 + 6x$

3. $f(x) = 0.25x^4 - 0.25x^3 - 4.5x^2 + 4x + 8$

I. Piecewise Functions – Section 1.3

Evaluate the following piecewise functions at the given values of the independent variable:

1. $f(x) = \begin{cases} 2x+3, & x < 0 \\ x, & x \geq 0 \end{cases}$ Determine $f(0)$

2. $f(x) = \begin{cases} |x-4|, & x \leq 4 \\ 5, & x > 4 \end{cases}$ Determine $f(3)$

3. $f(x) = \begin{cases} \sqrt{4-x}, & x < -3 \\ 3x, & x \geq -3 \end{cases}$ Determine $f(-2)$

J. Domains of Functions – Section 1.2-1.3

Find the domain of the following functions:

1. $f(x) = \dfrac{x}{x^2 + 2x - 3}$

2. $f(x) = \dfrac{2x}{x^2 - 4}$

3. $f(x) = \sqrt{13x + 5}$

4. $f(x) = \sqrt{6x + 7} - 9$

5. $f(x) = 2x - \sqrt[3]{13x - 7}$

K. Applications of Quadratic Functions – Section 2.2

1. A projectile is shot from a 350 foot cliff. The quadratic function, $s(t)$, models the projectile's height above ground, $s(t) = -15t^2 + 90t + 350$, in feet, t seconds after it was shot. When does it reach maximum height? What is the maximum height?

2. An airplane manufacturer can produce up to 15 planes per month. The profit made from the sale of these planes can be modeled by $P(x) = -0.2x^2 + 4x - 3$ where $P(x)$ is the profit in hundred thousand of dollars per month and x is the number of planes made and sold. Based on this model, how many planes should be made and sold to maximize the profit and what is the maximum profit?

L. Finding Values on a Graph – Sections 1.2-1.3

Given the following graphs for f(x), for what values of x does $f(x) = 2$?
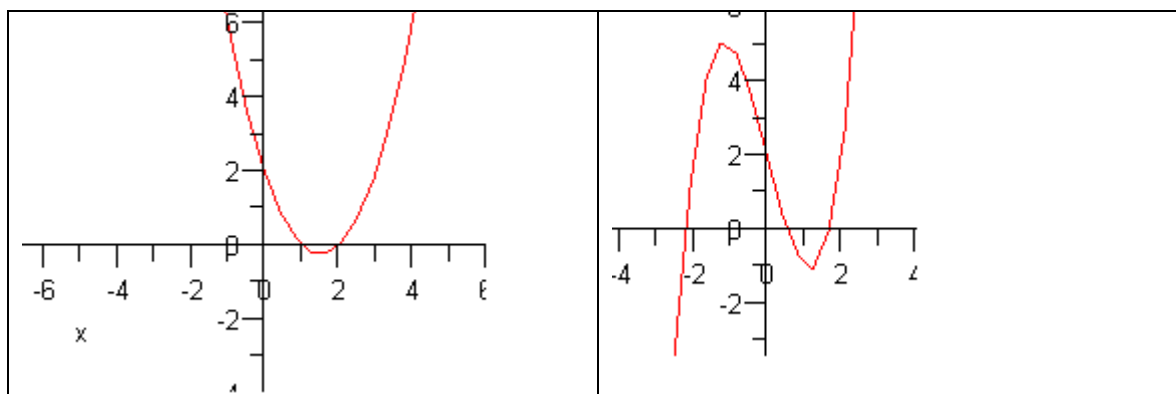
M. Even/Odd functions – Section 1.3
Perform the algebraic tests for even and odd to determine if the function are even, odd or neither.

1. $f(x) = x^5 - 6x^3 + 5x$
2. $f(x) = 7x^2 + 4x + 9$
3. $f(x) = x^4 - 3x^2 + 11$

N. Function behavior – Section 1.2
For the function $f(x) = \sqrt{x+4} - 4$, find followings.

1. domain
2. range
3. x-intercept if any as an ordered pair
4. y-intercept if any as an ordered pair