MAT170 Precalculus Exam 01 - Review

1. The population of Ukraine was 48.68 million in 2001 and dropped to 45.49 million in 2013. Assuming the population decreases at a constant rate, find the equation of the line which relates the population of Ukraine as a function of the number of years since 2000.

2. Let $f(x) = -x^2 - 2x + 1$ and $g(x) = \frac{1}{x+2}$

- **a.** Find $f(g(x))$. What is the domain of $f \circ g$?
- **b.** Find $g(f(x))$. What is the domain of $g \circ f$?

3. Let $r(t) = x^3 - 2x - 5x + 6$.

- **a.** Use the rational root theorem to find a list of possible rational roots.
- **b.** Find the roots of r.
- **c.** What is the multiplicity of each root?
- **d.** What is the end behavior of r?
- **e.** What is the y-intercept of r?
- **f.** Use the previous parts to graph r. *You should be able to do this without a calculator*

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

- **a.** Find the domain of g.
- **b.** Find the y-intercept.
- **c.** Find the roots of g.
- **d.** Find the holes of g.
- **e.** Find the vertical asymptote of g.
- **f.** Describe the end behavior of g. What are the horizontal asymptotes, if any?
- **g.** Use the previous parts to graph g. *You should be able to do this without a calculator.*

5. Suppose the cost (in dollars) for Yamaha to manufacture xylophones is modeled by the function $c(x) = x^2 - 2x + 100$ where x is the number of xylophones manufactured.

- **a.** Find the number of xylophones that Yamaha should manufacture that minimizes the cost.
- **b.** What is the minimum cost?
- **c.** What is the average rate of change in cost when Yamaha increases the number of xylophones manufactured from 5 to 9?

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

- **a.** What is the domain of f? What is the range?
- **b.** Is f a function? Explain your reasoning.
- **c.** Assuming f is invertible, find the inverse of f.
- **d.** Is f^{-1} a function? Explain your reasoning.

7. Let $g(x) = 6x^2 + 5x - 17$.

- **a.** Find the difference quotient $\dfrac{g(x+h) - g(x)}{h}$, $h \neq 0$, of g. Simplify this.
- **b.** Use the Intermediate Value Theorem to prove that there is a root of g between $x = 1$ and $x = 2$.

8. Suppose $w(x) = (x+1)^3 - 4$.

a. Find two unique pairs of functions f and g such that $w(x) = (f \circ g)(x)$.

b. Identify the transformations done to the parent function $z(x) = x^3$.

9. Algebraically simplify and rewrite each of the following complex numbers in standard form $a + bi$:

a. $(2 - i) + (4 + 7i)$

b. $(4 + 2i) - (3i)$

c. $(2 + 9i)(3 + 2i)$

d. $\dfrac{6 + 8i}{2 - 7i}$