

MATH 161: GROUPWORK I

24th August 2015

(Problems selected from the University of Michigan precalculus final, Winter 2010.)

1. The population of a particular nest of bumblebees t minutes after observation begins is given by $P(t) = P_0 2^{ct}$ for some positive constant c . For each of the following, fully simplify and give your answers in *exact form*. Note that your answers may involve the constants P_0 and/or c .



What is the doubling time of this population?

2. Suppose that $m = T(k) = \frac{e^{2k} - 3}{5 + e^{2k}}$. Find a formula for $T^{-1}(m)$.
3. Suppose m is a function with zeroes $x = -2$, $x = 1$, and $x = 5$ and horizontal asymptote $y = 3$. Let g be the function given by $g(x) = 3m(x - 1)$.
 - (a) Find the zeroes of g .
 - (b) Find the equation of a horizontal asymptote of g .

4. In this problem, the constants a , b , c and d are all positive and different from each other. Consider the function $R(x) = \frac{x^2(x+a)}{(bx^2+c)(x+d)}$.

Note: Your answers may involve the constants a , b , c , and/or d .

- (a) What is the y-intercept of R ? If there is not a y-intercept, write NONE.
- (b) Find all zeroes of R . If there are no zeroes, write NONE.
- (c) Find the equation(s) of all vertical asymptote(s) of R . If there are none, write NONE.
- (d) Find the equation(s) of all horizontal asymptote(s) of R . If there are none, write NONE.

5. A company has 30 inch by 50 inch rectangular pieces of scrap sheet metal from which it wants to construct containers by cutting square pieces from each corner and bending the resulting flaps upward to form sides.
****Remember to show your work/reasoning.**** In particular, if you use a graph or diagram, include a labeled sketch and indicate what you found on it.

(a) Find a formula for the volume $V = g(c)$, in cubic inches, of a container obtained by cutting the square pieces of side length c inches from each corner.

(b) In the context of this problem, what is the domain of g ? (Use interval notation.)