MATH 151.02 **GROUPWORK 1** September 29, 2009

NAMES: ______________________________

1.(3pts.) Find the domain of each of the following functions:

a) $f(x) = \sqrt{x-2}$

$x-2 \geq 0$

$x \geq 2$ $D_f = [2, \infty)$

b) $g(x) = \frac{1}{\sqrt{x-2}}$

$x - 2 \geq 0$, $x \neq 2$

$x \geq 2$ $\Rightarrow D_g = (2, \infty)$

c) $h(x) = \frac{1}{x^2 - x}$

$x^2 - x \neq 0$

$x(x-1) \neq 0 \Rightarrow x \neq 0$ & $x \neq 1$ $D_h = (-\infty, 0) \cup (0,1) \cup (1, \infty)$

2.(3pts.) Find the range of each of the following functions:

a) $f(x) = x^2 - 3$

$x^2 \geq 0$

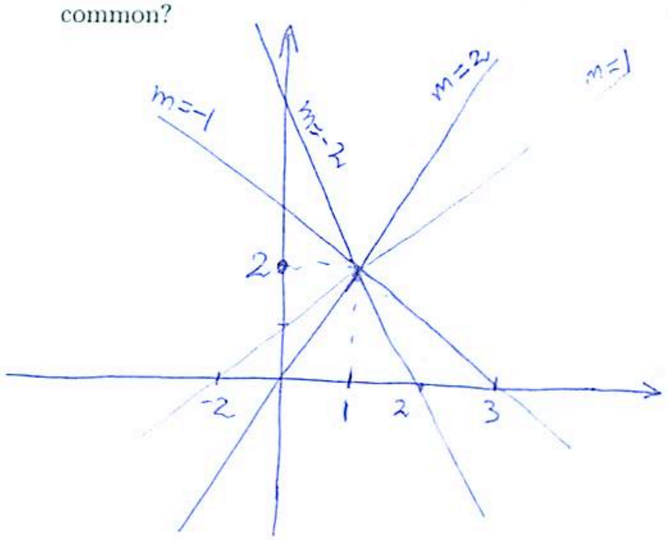
$x^2 - 3 \geq 0 - 3 = -3$ $R_f = [-3, \infty)$

b) $g(x) = |x+5|$

$D_g = [0, \infty)$

3.(3pts.)

a) Sketch the graphs of functions $y = 2 + m(x-1)$ for $m = -2, -1, 1, 2$. What do these functions have in common?



They all pass through the point $(1,2)$

b) What do all members of the family of lines $f(x) = b - x$ $(b \in \mathbb{R})$ have in common?

The all have slope $m = -1$ (so, they are parallel)

4.(3pts.) Find the equation of the line that passes through (2,1) and is parallel to the line $y = -\frac{x}{2} - 2$.

$\leftarrow m = -\frac{1}{2}$

$y - 1 = -\frac{1}{2}(x - 2)$

$y - 1 = -\frac{x}{2} + 1$

$y = -\frac{x}{2} + 2$

5.(4pts.) In 2007, the world's population reached 6.7 billion and was increasing at a rate of 1.2% per year. Assume that this growth rate remains constant. (In fact, the growth rate has decreased since 1987.)

a) Write a formula for the world population (in billions) as a function of the number of years since 2007.

$a = 1 + 1.2\% = 1 + .012 = 1.012, \quad P_0 = 6.7$

$P(t) = P_0 \cdot a^t = 6.7 \cdot (1.012)^t$

b) Use your formula to estimate the population of the world in the year 2020.

$P(13) = 6.7 \cdot (1.012)^{13} \approx 7.824$

6.(4pts.)

a) The half-life of radium-226 is 1620 years. Write a formula for the quantity, Q, of radium left after t years, if the initial quantity is Q_0.

$Q(t) = Q_0 a^t$

$\frac{Q_0}{2} = Q(1620) = Q_0 a^{1620}$

$\frac{Q_0}{2} = Q_0 a^{1620} \; / :Q_0$

$a^{1620} = \frac{1}{2} \Rightarrow a = \sqrt[1620]{\frac{1}{2}} = \frac{1}{2^{1/1620}} = 2^{-\frac{1}{1620}}$

$Q(t) = Q_0 \cdot 2^{-\frac{t}{1620}}$

b) What percentage of the original amount of radium is left after 500 years?

$Q(500) = Q_0 \cdot 2^{-\frac{500}{1620}} = Q_0 2^{-\frac{25}{81}} \approx Q_0 \cdot 0.8074$

So, about 80.74% of the original amount Q_0 is left after 500 years