TMath 120

NAME:

1. [6] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F. Let f be a function, and x, y, and z be real numbers with $z \neq 0$.

   T F $\dfrac{3x+y}{3z} = \dfrac{x+y}{z}$

   T F $f(x+1) = f(x) + 1$

   T F $\sqrt{-4} = -\sqrt{4}$

   T F $\sqrt{x^2 + y^2} = x + y$

   T F $\dfrac{1}{1+i} = \dfrac{1}{2} - \dfrac{1}{2}i$

   T F $f(f^{-1}(2)) = 2.$

   Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).
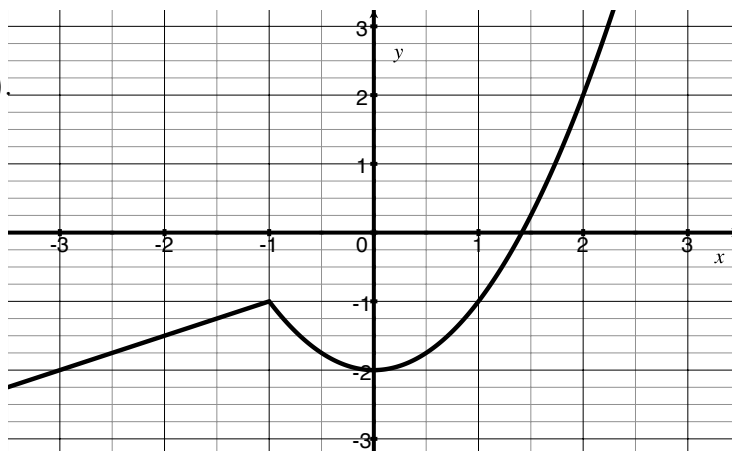
2. [3] (§2.1 #46) Find any real or imaginary x such that $3(x-1)^2 + 4 = 4$.

3. Let f be the function comprised of a line and a parabola whose graph is below:

(a) [1] (WebHW1 #21)
Estimate the x intercept(s).

(b) [1] (§1.3 #56)
Estimate $f(-3)$
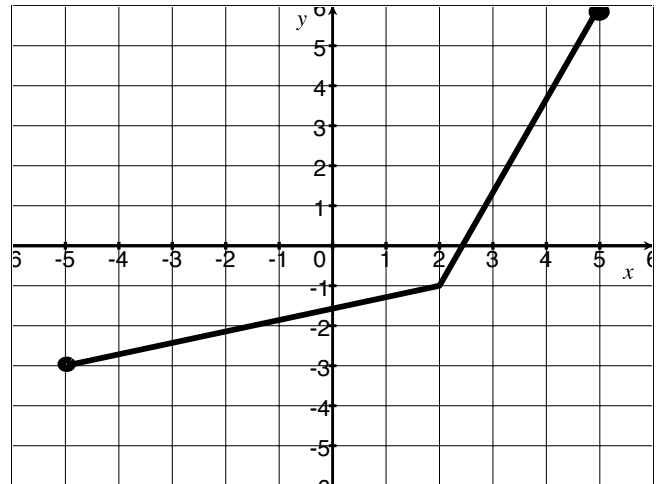
(c) [2] (Practice Exam)
$(f \circ f)(0)$

(d) [4] (Quiz2 #3) Find the piece-wise defined algebraic rule of g in the form below.

$$g(x) = \begin{cases} & \text{if } x < -1 \\ & \text{if } -1 < x \end{cases}$$

(e) [3] (WebHW3 #19) Graph the function $g(x) = \frac{1}{2}f(x) + 1$ on the axes above.

4. Let z be the function whose graph is shown to the right.

(a) [1] (TransformationSheet #5)
Find the range of z.

(b) [2] (PracticeExam #8)
Find the equation of the line that passes though $(-3, 2)$ and makes a right angle when intersecting z.

(c) [2] (§1.7 #40) Draw the graph of z^{-1} on the above axes if it exists.

5. Let the domain of f be undergraduate majors and $f(x)$ be the median annual earnings of people with the the undergraduate major x.
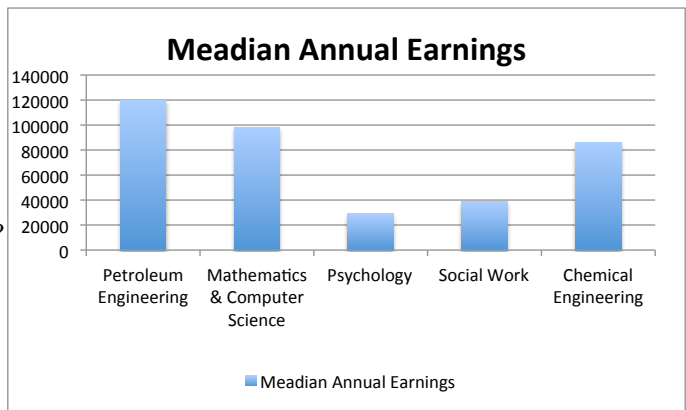
(a) [2] (PracticeExam #9)
Is f a function? Why are why not?

Meadian Annual Earnings

(b) [1] (PracticeExam #9) Find an x such that $f(x) \leq 40,000$.
Note: the median household income in the US is \$59,039.

6. Let $q(x) = \dfrac{9x + 2}{x + 6} + 3$ and $r(x) = x + 3$

   (a) [2] (WebHW2 #16) Find the average rage of change of q from 0 to 2.

   (b) [1] (§1.6 # 20) Find $(q - r)(x)$.

   (c) [3] (WebHW5 #16) Given that q is one-to-one (ie has an inverse), find q^{-1}.

7. [2] (§A.8 #18) Compute the product of $-1 + i$ and $2 - 10i$.

8. [4] (PracticeExam #11) A rectangular box with a volume of 60 ft^3 has a square base. Find a function that models its surface area S in terms of the length of one side of its base.

9. [5] Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.
No, doing both questions will not earn you extra credit.

(a) You have 8oz of coffee which has about .003oz of caffeine sitting in a 24oz cup. You would like a higher dose of caffeine and plan to add $x$oz of espresso which has .0028oz per 2oz shot.

- Write an expression that returns the percentage (as a decimal) of caffeine in the cup as a function of espresso that you add.
- Give the domain of this function and justify your answer.

(b) You have \$5500 in a ROTH retirement fund and would like a return of 4% (to do slightly better than inflation which has been 2.9% lately). There are 5 year CDs (certificate of deposits) being offered with an annual rate of 3.05% and index funds (a collection of stocks from companies included in measures like the S&P 500) that returned 8.2% since the 1990's (Thomson Reuters, 2010 S&P 500 Composite Index total return for the period 12/31/1989 to 12/31/2009). How much money do you relegate to a CD and how much money do you put in an index fund to get an annual return of 4%?