Exam 1 # TMath 120 Autumn 2021

NAME:

1. [4] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F.

   T F $\frac{1}{a} + \frac{1}{b} = \frac{2}{a+b}$

   T F Given a function $f$ with an inverse, $f^{-1}(f(2)) = 2$

   T F $\frac{-1}{3+i} = \frac{-3}{8} + \frac{1}{8}i$

   T F The number 5 is both a complex number and a polynomial.

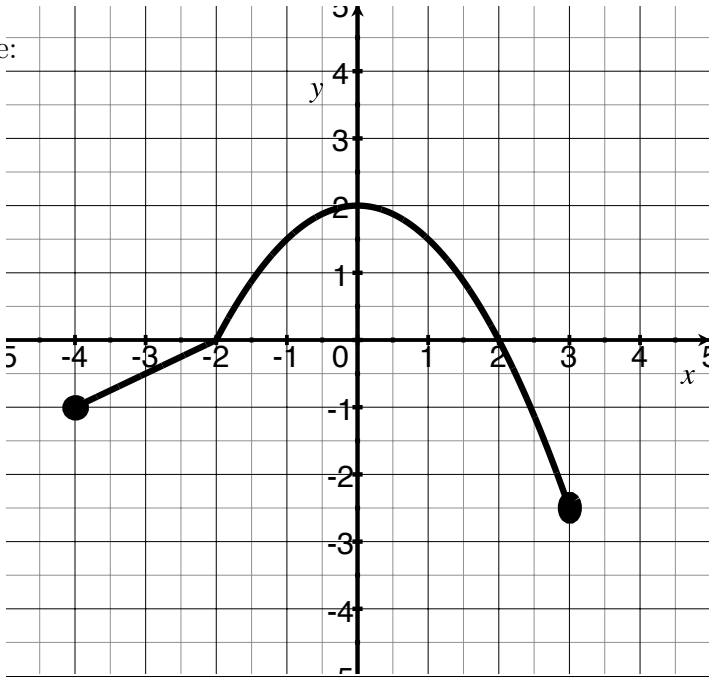
Show all your work. Reasonable supporting work must be shown to earn credit.

2. The height (in feet) of an open toy box, that is twice as long as it is wide, is given by $\frac{27-4x^2}{12x}$, where $x$ is the width of the box.

   (a) [2] (Quiz1 #2) Find the length of the box when the width is 1.5 feet.

   (b) [3] (WordProblem #3) Write an expression in x whose value gives you the volume of the toy box.

3. Let $f$ be the piece-wise defined function comprised a line and a parabola shown below.




(a) Estimate the following *if* possible:

i. [1] (WebHW §1.3 #6) $f(-1)$

ii. [2] (WrittenHW§1.6 #36) $(f+f)(0)$

iii. [2] (Quiz2 #1) $(f(f(-4))$

iv. [1] (WrittenHW§1.1 #104) the maximum of $f$.

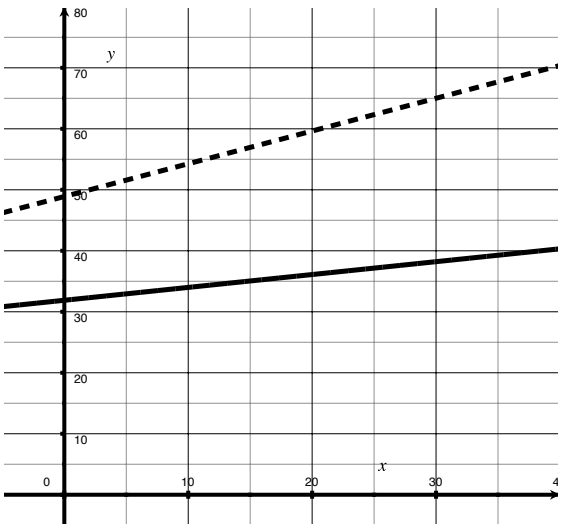
v. [2] (Transformations Activity #5) all possible $x$ such that $f(x) = 1$.

(b) [4] (PracticeExam #4) Find the formula for $f$ in the indicated form:

$$f(x) = \begin{cases} & \text{if } -4 \leq x \leq -2 \\ & \text{if } -2 < x \leq 3 \end{cases}$$

(c) [3] (WebHW3 #16) Graph $2f(x) + 1$.

4. (LineActivity #7) The functions below (approximately) return the median annual income (reported in thousands of dollars) of Americans since 1960 for Asian Americans (A) and Latinx Americans (L).




(a) [2] Let $x$ be the years since 1960, then $A(x) = .537x + 48.900$, and $L(x) = .211x + 31.886$. Identify which line is $L$ and justify your choice.

(b) [2] Which population has a bigger median annual income in 1990? Justify your answer.

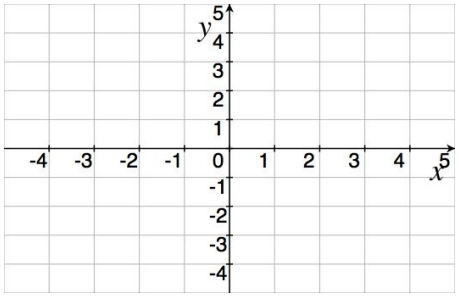
(c) [3] Will $A$ and $L$ intersect? Justify your answer and interpret the practical significance.

(d) [3] (WrittenHW§1.7 #78) Find the algebraic rule/expression for $A^{-1}(x)$.

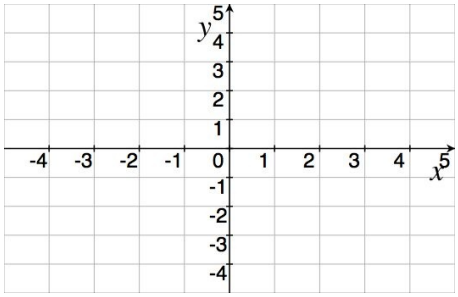
5. [3] (PracticeExam, #7) Find the real or complex solutions to $3(7 + x)^2 + 4 = 2$.

6. Provide a graph AND an algebraic rule/expression for each of the functions described below:

   (a) [4] (Polynomial Activity#4) A degree 3 polynomial whose only roots are $-2$ & 4.




   (b) [4] (Line Activity#13) A line perpendicular to $y = \frac{1}{3}x + 2$.




7. 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) (Workshop) A salesperson find that her sales average 41 cases per store when she visits 20 stores a week. Each time she visits three additional stores per week, the average sales per store decrease by 2 cases.

      i. [3] Write a rule/expression that returns the salesperson's total sales as a function of stores she visits each week.

      ii. [2] How many stores should she visit if she wants to maximize her sales?

   (b) (WordProblems #3)) A full radiator contains 8 quarts of fluid, 40% of which is antifreeze.

      i. [3] Write a rule/expression that returns the percentage (as a decimal) of antifreeze as a function of antifreeze that you add.

      ii. [2] How much fluid should be drained and replaced with pure antifreeze so that the new mixture is 60% antifreeze?