

1. **(20 points)** Answer the following questions about optimization:

- (a) **(8 points)** The total cost of producing  $x$  units of a product is  $C = 3x^2 - 90x + 1000$ . Find the value of  $x$  for which the total cost is minimum.

- (b) **(12 points)** There are 600 people who would attend a Deathmøle concert, if it were free. Every dollar charged for admission will reduce attendance by 24 people. What price for concert admission will maximize the total revenue? Show your work.

	FOR GRADER USE ONLY
1	/20
2	/20
3	/15
4	/20
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2. **(20 points)** Answer the following questions involving the functions  $f(x) = \frac{1}{x}$  and  $g(x) = 2 - \sqrt{x+5}$ .
- (a) **(5 points)** Find formulas for  $(f+g)(x)$ ,  $(f-g)(x)$ ,  $(fg)(x)$ , and  $\frac{f}{g}(x)$ . Label which is which. You do not need to algebraically simplify your results.
- (b) **(5 points)** Find formulas for  $(f \circ g)(x)$  and  $(g \circ f)(x)$ . Label which is which. You do not need to algebraically simplify your results.
- (c) **(5 points)** Determine the domain of  $f(x)$  and the domain of  $g(x)$ . Label which is which.
- (d) **(5 points)** Determine the domain of each of  $(f+g)(x)$ ,  $(f-g)(x)$ ,  $(fg)(x)$ , and  $\frac{f}{g}(x)$ . Label which is which.

3. **(15 points)** Find a function  $y = f(x)$  fitting the description of each of the following graphs:
- (a) **(5 points)** A line through  $(-2, 1)$  and  $(0, 7)$ .
  
  - (b) **(4 points)** A line of slope  $-2$  through the point  $(-1, 7)$ .
  
  - (c) **(6 points)** A quadratic with vertex at  $(-3, -2)$  which passes through the point  $(0, -8)$ .
4. **(20 points)** Answer the following questions about functions:
- (a) **(7 points)** Write an equation for a function whose graph fits each of the given transformations of  $y = \sqrt{x}$ :
    - i. **(2 points)** The graph of  $f(x) = \sqrt{x}$  is reflected over the  $x$ -axis.
  
    - ii. **(2 points)** The graph of  $f(x) = \sqrt{x}$  is stretched vertically by a factor of 3.
  
    - iii. **(3 points)** The graph of  $f(x) = \sqrt{x}$  is shifted upwards by two units and right by four units.
  
  - (b) **(5 points)** Determine the inverse function of  $g(x) = 5x - 3$ .
  
  
  
  
  
  
  
  
  
  
  - (c) **(7 points)** Find the  $x$ -intercepts,  $y$ -intercept, and long-term behavior (or end behavior) of the function  $h(x) = (4x - 2)(x + 1)^2(x - 4)$ .