

This test is closed-book and closed-notes. No calculator is allowed for this test. For full credit show all of your work (legibly!), unless otherwise specified.

1. **(10 points)** Let  $f(x) = 3x^2 - 5x - 2$ .

(a) **(6 points)** At which values of  $x$  does  $f(x) = 0$ ?

(b) **(4 points)** What is the average rate of change of the function  $f(x)$  between the values  $x = -2$  and  $x = 0$ ?

2. **(15 points)** I want to make five liters of a 60% sucrose solution; I have large quantities of 30% sucrose and 70% sucrose. How much should I blend from of these two solutions to get the desired mixture?

1	/10
2	/15
3	/15
4	/10
5	/23
6	/ 9
7	/13
$\Sigma$	/95

3. (15 points) Perform the following arithmetic and algebraic operations.

(a) (5 points) Simplify the expression  $\frac{(x^2y)^3}{x(y^2z)^2}$ .

(b) (6 points) Simplify the rational expression  $\frac{x+1}{x^2-2} - \frac{2}{x-1}$ .

(c) (4 points) Calculate  $(-8)^{5/3}$ .

4. (10 points) Linh is in a class where the grade is determined based solely on exams, and where the final exam is worth twice as much as the three midterms. If Linh got grades of 75%, 82%, and 71% on the three midterms, what grade will she need on the final exam to get an 80% overall in the class?

5. **(23 points)** Answer the following questions about the functions  $f(x) = x^3 - 8$  and  $g(x) = \sqrt{x - 3}$ . In each question asking for multiple answers, *label which is which*.

(a) **(5 points)** Find the inverse of the function  $f(x)$ .

(b) **(3 points)** Write formulas, which need not be simplified, for  $(g - f)(x)$  and  $\frac{f}{g}(x)$ .

(c) **(4 points)** Write formulas, which need not be simplified, for  $f(g(x))$  and  $f(f(x))$ .

(d) **(5 points)** Determine the domains of  $f(x)$  and  $g(x)$ .

(e) **(6 points)** Determine the domains of  $(f + g)(x)$ ,  $(f - g)(x)$ ,  $(fg)(x)$ ,  $\frac{f}{g}(x)$ , and  $\frac{g}{f}(x)$ .

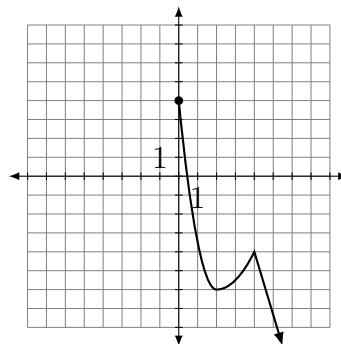
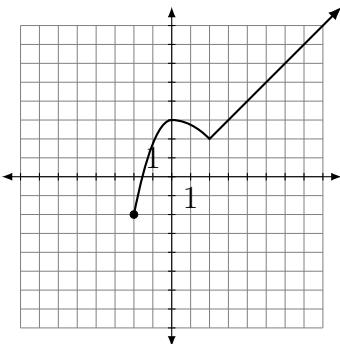
6. (9 points) A bathtub holds 50 gallons of water and is currently filled. The drain is opened, causing water to flow out at a constant rate, and 3 minutes later, the bathtub only contains 14 gallons of water.

(a) (5 points) Write a function  $f(t)$  to represent the volume of water still in the tub  $t$  minutes after opening the drain.

(b) (4 points) How many minutes will it take the tub to empty completely?

7. (13 points) Answer the following questions about functions and their graphs.

(a) (5 points) A function  $f(x)$  is shown on the graph to the left, and a transformation  $g(x)$  of this function is shown on the right. Find a formula for  $g(x)$  in terms of the formula for  $f(x)$ .



(b) (3 points) For  $f(x) = \begin{cases} x^2 - 3 & \text{if } x < 4 \\ \sqrt{x} & \text{if } x \geq 4 \end{cases}$ , calculate the following values:

- $f(1)$ .
- $f(4)$ .
- $f(9)$ .

(c) (5 points) Determine the equation of the line through the points  $(2, 1)$  and  $(8, 3)$ .