

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
Σ	/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 $\frac{g}{f}(x)$.

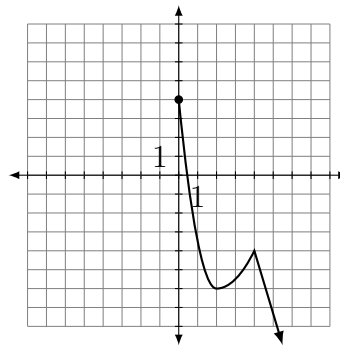
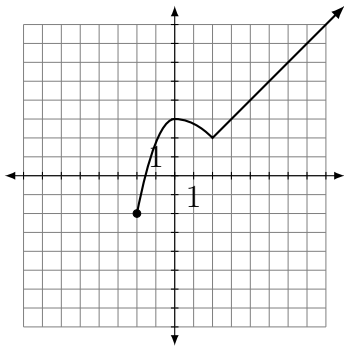
6. **(9 points)** A bathtub holds 50 gallons of water and is currently filled. The drain is opened, causing water to flow out at a constant rate, and 3 minutes later, the bathtub only contains 14 gallons of water.

(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 $(8, 3)$.