1. Find the area of the region(s) bounded by $3x + y^2 = 9$ and $y = \frac{2x + 1}{2}$.

2. Find the number(s) $d$ such that the average value of $f(x) = x^2 - 12x + 32$ on the interval $[0, d]$ is 6.

3. What is the domain of $f(x) = \frac{\ln(5x - 8)}{2x^2 + x - 21}$?

4. If $g(x) = -2f(x - 1) + 3$, describe how you would obtain the graph of $g(x)$ if you are given the graph of $f(x)$.

5. A certain culture is known to double every five hours. Suppose that the culture initially has a mass of 100 mg. What is the size of the culture after 34 hours?

6. Find the inverse of $f(x) = \frac{3x - 1}{4x + 7}$.

7. An object moves back and forth along a straight line. Its position is given by $s(t) = 3t^2 - 4t + 2$, $t \geq 0$, where $s$ is in feet and $t$ is in seconds. What is the average velocity of the particle on the interval $[1, 1.1]$?

8. Use the graph of $f(x)$ below to determine the following:

![Graph of $f(x)$]

(a) $\lim_{x \to -1} f(x)$

(b) $\lim_{x \to 2^+} f(x)$

(c) $\lim_{x \to \infty} f(x)$

(d) the value(s) of $x$ for which $f(x)$ is discontinuous.

(e) the value(s) of $x$ for which $f(x)$ is non-differentiable.

9. Evaluate the following limits:

(a) $\lim_{x \to -4} \frac{2x^2 + 5x - 12}{x^2 + 2x - 8}$

(b) $\lim_{x \to \infty} \frac{5x^3 - 4x^2 + 2}{10 - x^2}$

10. Use the limit definition of the derivative to find $f'(x)$ for $f(x) = \sqrt{x - 2}$.

11. Find the derivative of each of the following functions:

(a) $f(x) = \frac{x^3 - \sqrt{x} + \frac{4}{x}}{\sqrt{x}}$

(b) $g(x) = \frac{(2x - 7)^4(2x - \ln x)^3}{\sqrt{5x - e^x}}$

(c) $h(x) = \cos(2x^2 - 7) + x\tan(x^2)$

12. Find the equation of the tangent line to the curve $y = \log_6(2x - 1) + x$ at $x = 1$.

13. An object’s height (in meters) above the ground is given by $h(t) = -t^2 + 6t$ after $t$ seconds. What is the velocity of the object after it has risen 8 meters?

14. Use a linear approximation to estimate $(16.01)^{1/4}$.

15. Find the absolute extrema of $f(x) = \sqrt{9 - x^2}$ on $[1, 2]$.

16. Let $f(x) = x\ln x$. Find the interval on which $f$ is increasing/decreasing, the local extrema of $f$, the intervals of concavity, and the inflection points.

17. A person has $30 available to build a storage box with a square base. The material for the top and bottom of the storage box costs $2 per square foot whereas the material for the sides costs $1.50 per square foot. Determine the dimensions of the storage box that would maximize the volume.

18. Use the Midpoint Rule with $n = 4$ to approximate $\int_1^6 (\ln x + 2)\,dx$.

19. Evaluate the following integrals:

(a) $\int (x^2 + 5x - \cos(2x) + \sqrt{x})\,dx$

(b) $\int_1^4 \left( \frac{x^2 + 7x}{3\sqrt{x}} \right)\,dx$

(c) $\int \frac{30x + 3}{10x^2 + 2x - 4}\,dx$

20. Find $f'(x)$ if $f(x) = \int_x^3 \frac{t^2}{1 + t^2}\,dt$.