1. A function $f$ satisfies $f'(x) = 3x^2 - 2x$ and $f(1) = 2$. What is $f'(0)$?
   
   (A) 0  (B) 2  (C) 4  (D) 5  (E) 6

2. A function $f$ satisfies $f'(x) = 3x^2 - 2x$ and $f(1) = 2$. What is $f(3)$?
   
   (A) 13  (B) 16  (C) 18  (D) 20  (E) 24

3. A function $G$ satisfies $G'(x) = 2x\sqrt{3x^2 + 1}$ and $G(0) = 11/9$. What is $G(1)$?
   
   (A) 1/3  (B) 4/9  (C) 13/9  (D) 23/9  (E) 25/9

4. Consider the function $f$ defined by:
   
   $$f(x) = \begin{cases} 
2x^2 - 3 & \text{if } x < 0 \\
5x - 3 & \text{if } x \geq 0
\end{cases}$$

   Find the slope of the line tangent to $f$ at the point $(-2, 5)$
   
   (A) $-8$  (B) $-4$  (C) 0  (D) 5  (E) 7

5. Let $f(x) = 2x^2 + x$. Evaluate and simplify $\frac{f(x + h) - f(x)}{h}$.
   
   (A) $4x + 1 + 2h$  (B) $4x - 2h + h^2$  (C) $4x + 2h$
   (D) $4x + 2h + 2$  (E) $x^2 + 2h + 2$
6. Questions (a) through (e) refer to the graph of the fourth degree polynomial function \( f \) given below.

(a) The number of roots of \( f''(x) = 0 \) is

(A) 0  (B) 1  (C) 2  (D) 3  (E) 4

(b) A good estimate of \( f'(-2) \) is

(A) -1  (B) 0  (C) 1  (D) 2  (E) there is no good estimate

(c) A good estimate of \( f''(-1) \) is

(A) -1  (B) 0  (C) 1  (D) 2  (E) there is no good estimate

(d) A good estimate of \( f'(2) \) is

(A) -3  (B) -1  (C) 0  (D) 1  (E) 2

(e) A good estimate of \( f'(0) \) is

(A) -2  (B) -1  (C) 0  (D) 0.8  (E) 3.2

7. The line tangent to the graph of a function \( f \) at the point \((3, 2)\) has \( y \)-intercept 8. What is \( f'(3) \)?

(A) -2  (B) -1  (C) 0  (D) 1  (E) 2

8. What is the slope of the line tangent to the graph of \( f(x) = (2x)^{-2} \) at the point \((1,1/4)\)?

(A) -2  (B) -1  (C) -1/2  (D) -1/4  (E) -1/8

On all the following questions, show your work.

The next five problems count 10 points each. Compute the following antiderivatives.

9. \( \int 6x^2 + x - 1 \, dx = 2x^3 + x^2/2 - x + c \)
10. \[\int 6x^2 + x^{-\frac{1}{2}}\,dx = 6 \cdot 2/5 \cdot x^{5/2} + 2x^{1/2} + c\]

11. \[\int \frac{3x^2 + 2x - 1}{x}\,dx = \int 3x + 2 - 1/x\,dx = 3x^2/2 + 2x - \ln|x| + c\]

12. \[\int \frac{2x + 1}{x^2 + x - 3}\,dx = \ln|x^2 + x - 3| + c\]

13. \[\int 2xe^{-x^2}\,dx = -e^{-x^2} + c\]

(45 points) Compute the following integrals.

14. \[\int_0^5 2x - 3\,dx = (x^2 - 3x)|_{x=5} = 25 - 15 - 0 = 10\]

15. \[\int_1^e \frac{1}{x}\,dx = (\ln|x|)|_{x=1} = \ln e - \ln 1 = 1 - 0 = 1\]

16. \[\int_0^1 \frac{e^{-x}}{1 + e^{-x}}\,dx = \ln[(1 + e^{-x})]|_{x=1} = -\ln(1 + e^{-1}) + \ln 2 \approx 0.380\]

17. (20 points) Find the area of the region that is completely enclosed by the graphs of \(f(x) = x^2 + 9x - 2\) and \(g(x) = 3x - 7\).

The functions agree at the two points \((-5, -22)\) and \((-1, -10)\), and the linear function is larger over the interval \([-5, -1]\), so the integral we want is \[\int_{-5}^{-1} (3x-7)-(x^2+9x-2)\,dx\]. Subtracting and antidifferentiating yields \[\int_{-5}^{-1} -x^2 - 6x - 5\,dx = -x^3/3 - 3x^2 - 5x\]|_{x=-5}^{x=-1} = 10.333.\]