[16] 1. Find each limit if it exists. If it does not exist, write DNE.

a) $\lim_{x\to 3}\left(\frac{2}{x}+\frac{x}{2}\right)$

b) $\lim_{x\to 5+}\frac{-2x}{x-5}$

c) $\lim_{x\to -\infty}\frac{\sqrt{16x^2+15x+14}}{2x-5}$

d) $\lim_{x\to 6}\frac{x^2+2x-48}{x^2-18x+72}$

[28] 2. Differentiate the following. You do NOT need to simplify.

a) $f(x) = e^{x^2} 5x$

b) $H(x) = \ln(7x^3 + 3x - 12)$

c) $G(x) = (7x^2 + 4x + 5)^9 + \sqrt{4x + 10}$

d) $F(x) = \dfrac{8x^4 + 9x + 2}{5 - x^2}$

[18] 3. Let $F(x) = \dfrac{5x - 48}{x^2 - 10x - 24}$

a) Find $F'(x)$. (Do not simplify.)

b) What is/are the equation(s) of the horizontal asymptotes?

c) What is/are the equation(s) of the vertical asymptotes?

d) What are the x-intercepts and y-intercepts of $F(x)$? Give your answers as ordered pairs.

i) x-intercept(s) ii) y-intercept(s)

[14] 4. Find the absolute maximum and minimum of $F(x) = (x^2 - 8x + 12)^3$ over $[-1, 5]$.

[14] 5. Let $F(x) = -x^3 + 6x^2 + 36x - 11$.

a) Find the intervals $F(x)$ is increasing.

b) Find the inflection point(s) as ordered pairs.

c) Find the interval(s) $F(x)$ is concave down.

d) Find the extrema and state whether they are maxima or minima.

[12] 6. Find the equation of the line tangent to $G(x) = \dfrac{e^{3x} + e^x + 4}{e^x + 2}$, where $x = 0$. Give your answer in slope-intercept form.

7. Integrate.

[5] a) $\int (6x - 3)dx$

[8] (b) $\int (e^{-2x} + \sqrt[3]{x} + 6x^2)dx$

[20] 8. Evaluate each integral.

a) $\displaystyle\int_1^4 x\sqrt{3x^2+1}\,dx$

b) $\displaystyle\int_1^{e^2} \frac{3}{x}\,dx$

c) $\displaystyle\int_0^1 2xe^{4x}\,dx$ (Integration by parts.)

[15] 9. Find the area between the curves $F(x) = 2x^2 + 4x + 5$ and $G(x) = x^2 + 7x + 9$.

[14] 10. Minimize $F(x, y) = -4x^2 - 3y^2$ subject to the constraint $2x + y = 80$.

[12] 11. Let $F(x, y) = e^x \ln y + e^y \ln x$.

a) Find $F_x(1, 1)$.

b) Find $F_{xy}(2, 3)$.

[12] 12. The critical points of $F(x, y) = 6x^2 - 3xy + y^3$ are (0,0) and $\left(\frac{1}{16}, \frac{1}{4}\right)$. Classify each point as a relative minimum, relative maximum or a saddle point.

[12] 13. $D(x)$ represents the price in dollars a consumer will pay for x units of a product and $S(x)$ represents the price in dollars the producers will accept for x units of a product. If $S(x) = x^2 + 5x + 71$ and $D(x) = 3x^2 - 6x + 8$, find

a) The number of units of x at the equilibrium point.

b) The total revenue for the equilibrium point.

c) The consumer surplus rounded to the nearest cent at the equilibrium point.