Working together is encouraged, share ideas not calculations. Explain your steps. I will collect some subset of these problems. A page to write answers on will be distributed in class the day before the Mission is due.

Problem 297 Please read Sections 6.1 - 6.4 of the Lecture Notes.

Problem 298 Find the antiderivative $F(x)$ for $f(x) = 2x + 3$ for which $F(0) = 1$.

Problem 299 If the velocity of an object as a function of time t is given by $v(t) = 3e^t - 2t$ and the object is at $x = 0$ when $t = 0$ then find the position of the object as a function of time t.

Problem 300 If the acceleration of an object as a function of time t given by $a(t) = 6t^3$ and the initial velocity is $v = 2$ whereas the initial position is $x = 1$ when $t = 0$ then find $x(t)$ and $v(t)$.

Problem 301 Find an antiderivative $F(x)$ of $f(x)$ for which $F(0) = 0$.

(a.) $f(x) = 6x^2 - 8x + 3$

(b.) $f(x) = 1 - x^3 + 12x^5$

(c.) $f(x) = 5x^{1/4} - 7x^{3/4}$

(d.) $f(x) = 2x + 3x^{1.7}$

(e.) $f(x) = 10/x^9$

(f.) $f(x) = \sqrt[3]{x^2} -]sqrt x^3$

(g.) $f(x) = \dfrac{x^3 + 2x^2}{\sqrt{x}}$

(h.) $f(x) = 3\cos x - 4\sin x$

(i.) $f(x) = \dfrac{3}{x^2} - \dfrac{5}{x^4}$

(j.) $f(x) = 3e^x + 7\sec^2(x)$

(k.) $f(x) = 2x + 5(1 - x^2)^{-1/2}$

(l.) $f(x) = \dfrac{x^2 + x + 1}{x}$

Problem 302 Find the indefinite integrals indicated below.

(a.) $\displaystyle\int x\sqrt{x}dx$

(b.) $\displaystyle\int \frac{1 + 2x^2 + 3x^3}{\sqrt{x}} dx$

(c.) $\displaystyle\int (3 + \cos x)dx$

(d.) $\displaystyle\int \frac{dx}{3 + 3x^2}$

(e.) $\displaystyle\int \frac{dx}{\sqrt{4 - 4x^2}}$

(f.) $\displaystyle\int \tan^2\theta\, d\theta$: *hint:* $\tan^2\theta + 1 = \sec^2\theta$

(g.) $\displaystyle\int x(3 + x^4)dx$

(h.) $\displaystyle\int \left[\cos^3(x) + \sin^2(x)\cos x\right] dx$

Problem 303 Calculate the Left, Right and endpoint rules with $n = 4$ (calculate L_4, R_4) to approximate the area bounded by $y = f(x) = x^4 + x$ for $0 \leq x \leq 4$. Then, use the linked webtool: click on this link to billcookmath.com's sage-based area approximator-visualization tool to calculate L_{40}, R_{40}. Comment on whether L_n and R_n either over or under-estimate the true area bounded for $y = f(x)$ on $0 \leq x \leq 4$.

Problem 304 Calculate the Left, Right and endpoint rules with $n = 4$ (calculate L_4, R_4) to approximate the area bounded by $y = f(x) = cos(3x/8)$ for $0 \leq x \leq 4$. Then, use the linked webtool: click on this link to billcookmath.com's sage-based area approximator-visualization tool to calculate L_{40}, R_{40}. Comment on whether L_n and R_n either over or under-estimate the true area bounded for $y = f(x)$ on $0 \leq x \leq 4$.

Problem 305 Observe that $\frac{d}{dx}\frac{8}{3}\sin(3x/8) = \cos(3x/8)$. This shows you an antiderivative for $\cos(3x/8)$. Apply FTC II to calculate $\displaystyle\int_0^4 \cos(3x/8)\,dx$ and comment how your result compares to the numerical method used in previous problem.

Problem 306 Rewrite the infinite sums below as a definite integral and then use the FTC II to find the value of the sum.

(a.) $\displaystyle\lim_{n\to\infty}\sum_{j=1}^{n}\left(1+\frac{2j}{n}\right)^3\frac{2}{n}$

(b.) $\displaystyle\lim_{n\to\infty}\sum_{j=1}^{n}\cos\left(\frac{\pi j}{2n}\right)\frac{1}{n}$

(c.) $\displaystyle\lim_{n\to\infty}\sum_{j=1}^{n}\exp\left(\frac{j\ln(3/2)}{n}\right)\frac{\ln(3/2)}{n}$

Problem 307 Use the FTC II to calculate the area bounded by $y = x^4 + x$ with $0 \leq x \leq 4$. That is, calculate $\displaystyle\int_0^4 (x^4+x)\,dx$ via the amazing result of FTC II. Also, comment how your result compares to the numerical method used in Problem 138.

Problem 308 Calculate $\displaystyle\int_0^1 (x^3 + x^4 + x^5)dx.$

Problem 309 Calculate $\displaystyle\int_0^{2\pi} \sin\theta\,d\theta$. Does the result make sense graphically ?

Problem 310 If $\displaystyle\int_0^{\ln a} e^x\,dx = \int_0^{\pi/4} \sqrt{2}\cos x\,dx$ then find the value of a.

Problem 311 Calculate $\displaystyle\frac{d}{dx}\int_1^x \cosh^{-1}(t^2+3)\,dt$

Problem 312 Calculate $\displaystyle\frac{d}{dx}\int_{x^2}^{e^x} \frac{dt}{\sqrt{3+t}}$

Problem 313 Calculate $\displaystyle\int_{-1}^1 (t^2 + t^3)dt$

Problem 314 Calculate $\displaystyle\int_0^1 \left(\sqrt{x} + \sqrt[3]{x}\right)dx$

Problem 315 Calculate $\displaystyle\int_0^{\ln(2)} \cosh(x)dx$ and leave your answer as an exact fraction.

Problem 316 Calculate $\displaystyle\int_{-3}^{-1} \left(\frac{x+1}{x}\right)dx$

Problem 317 Calculate $\displaystyle\int_0^{1/2} \frac{dx}{\sqrt{1-x^2}}$

Problem 318 Calculate $\displaystyle\int_0^{1} \frac{x^2}{1+x^2}\,dx$

Problem 319 Calculate $\displaystyle\int_0^{\pi} \cos(x/2)\,dx$

Problem 320 Calculate $\displaystyle\int_0^{1} \sqrt{3x}\,dx$

Problem 321 Calculate the following definite integrals[1]:

(a.) $\displaystyle\int_{-1}^{3} x^5\,dx$

(b.) $\displaystyle\int_{1}^{2} x^{-2}\,dx$

(c.) $\displaystyle\int_{2}^{8} (4x+3)\,dx$

(d.) $\displaystyle\int_{0}^{4} (1+3y-y^2)\,dy$

(e.) $\displaystyle\int_{0}^{4} \sqrt{x}\,dx$

(f.) $\displaystyle\int_{\pi}^{2\pi} \cos\theta\,d\theta$

(g.) $\displaystyle\int_{-1}^{0} (2x-e^x)\,dx$

(h.) $\displaystyle\int_{-1}^{0} (2x-e^x)\,dx$

(i.) $\displaystyle\int_{0}^{1} x^{3/7}\,dx$

(j.) $\displaystyle\int_{1}^{2} \frac{3}{\eta^4}\,d\eta$

(k.) $\displaystyle\int_{1}^{4} \frac{dx}{\sqrt{x}}$

(l.) $\displaystyle\int_{1}^{2} \frac{x^2+1}{\sqrt{x}}\,dx$

(m.) $\displaystyle\int_{0}^{2} (x^3-1)^2\,dx$

(n.) $\displaystyle\int_{\pi/4}^{\pi/3} \sin t\,dt$

(o.) $\displaystyle\int_{1}^{2} \frac{4+w^2}{w^3}\,dw$

(p.) $\displaystyle\int_{0}^{1} u\left(\sqrt{u}+\sqrt[3]{u}\right)\,dw$

(q.) $\displaystyle\int_{0}^{5} \left(2e^x+4\cos x\right)\,dw$

[1] solutions to all of these are given in the pdf http://www.supermath.info/integrationhwk.pdf posted on my website

(r.) $\displaystyle\int_{\pi/6}^{\pi/3} \csc^2\theta \, d\theta$

(s.) $\displaystyle\int_1^8 \frac{x-1}{\sqrt[3]{x^2}} \, dx$

(t.) $\displaystyle\int_1^9 \frac{dx}{2x}$

(u.) $\displaystyle\int_{\ln 3}^{\ln 6} 8e^x \, dx$

(v.) $\displaystyle\int_8^9 2^t \, dt$

(w.) $\displaystyle\int_{\pi/3}^{\pi/2} \csc x \cot x \, dx$

(x.) $\displaystyle\int_0^{0.5} \frac{dx}{\sqrt{1-x^2}}$

(y.) $\displaystyle\int_0^{\pi/4} \frac{1+\cos^2\beta}{\cos^2\beta} \, d\beta$

(z.) $\displaystyle\int_1^2 |x - x^2| \, dx$

Problem 322 Integration can be used to formulate a given function. Consider $f(x) = \displaystyle\int_0^x \frac{dt}{1+t+t^2}$. Find all zeros of $f(x)$. Determine the intervals of increase and decrease for the given function. Classify any local extrema. Find the interval(s) on which this function is concave up or concave down. Does $y = f(x)$ have an inflection point ?