Thursday Math 135 review problems for section F2

I am skipping review problems on these topics, most of which were just covered on the second exam.

Riemann sums
1. Suppose $f(x) = 2x^2 - 1$. Write the Riemann sum for $f(x)$ on the interval $[-1, 5]$ with partition $\{-1, 2, 4, 5\}$ using the left-hand endpoints as sample points. You do not need to do the implied arithmetic!
2. Suppose $f(x) = \cos x$. Write the Riemann sum for $f(x)$ on the interval $[0, \frac{3}{2}\pi]$ obtained by partitioning the interval into 6 equal subintervals and using the right-hand endpoints as sample points. You do not need to do the implied arithmetic!

FTC
1. $\int_{-1}^{4} (2x - 5\sqrt{x}) \, dx$
2. $\int_{1}^{4} \frac{1-x}{\sqrt{x}} \, dx$
3. If $f(x) = \int_{-42}^{x} \frac{\sin(t^2)}{1+t^2} \, dt$, compute $f(-42)$, $f'(0)$, and $f'\left(\sqrt{\pi}\right)$ exactly.
4. $\int_{1}^{2} (3\sqrt{x} - \frac{1}{x^4}) \, dx$

Area
1. Sketch the region in the plane bounded by $y = 4 - x^2$ and the $x$-axis. Find the area of this region.
2. Sketch the region in the plane bounded above by $y = 4 - x^4$ and below by $y = 3$. Find the area of this region.
3. Sketch the region in the plane bounded by the $x$-axis, the line $x = 2$, and the curve $y = \frac{1}{3}x^5$. Find the area of this region.

Definite integral
1. Suppose $P$ and $Q$ are constants, and $f(x) = P\sin(7x) + Qx\cos(7x)$. Find specific values of $P$ and $Q$ so that $f'(x) = x\sin(7x)$. Use your answer to evaluate $\int_{0}^{\pi/7} x\sin(7x) \, dx$.
2. Suppose $f(x) = xe^x - e^x$. Compute $f'(x)$, and use your answer to evaluate $\int_{0}^{1} xe^x \, dx$ exactly.