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.

- **Linear approximation**
- **Related rates**
- **Optimization**
- **Intermediate Value Theorem**
- **Mean Value Theorem**
- **Curve sketching**

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. $\int_1^4 \frac{1-\sqrt{x}}{x} dx$
3. If $f(x) = \int_{-42}^{x} \frac{\sin(t^2)}{1+t^4} dt$, compute $f(-42)$, $f'(0)$, and $f'(\sqrt{\pi})$ exactly.
4. $\int_1^2 \left(3\sqrt{x} - \frac{1}{x^4}\right) dx$

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 $y = \frac{1}{9}x^5$. 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.