Math 1431 Test 4 Review

1. Find the derivative:
   a. $y = \ln\sqrt{e^x + 4\sinh(x)}$
   b. $y = \sin\left(\ln(5-x)^6\right)$
   c. $y = x^2 e^{2x} + \ln e^{2x}$
   d. $y = e^{x^2} \cdot \cosh(3x)$
   e. $f(x) = \ln(5x^2) + e^{6x} + \arctan(5-2x)$
   f. $y = (\tan x)^{(x^2+7)}$
   g. $f(x) = \arctan(2x^3)$
   h. $f(x) = \arcsin\left(3x^2\right)$
   i. $y = \cosh(3x) + \sinh(4x)$
2. Integrate:
   a. $\int_e^{4e} \frac{1}{x}\, dx$
   b. $\int \left(\frac{\csc^2 x}{2 + 5\cot x} - e^{9x} \right) dx$
   c. $\int \sec^2(3x)\, dx$
   d. $\int_0^{\pi/4} \sec(x)\tan(x)\, dx$
   e. $\int \frac{x+2}{x^3}\, dx$
   f. $\int \left(3x^3 - 2x^2 + 5\right) dx$
   g. $\int_1^4 \sqrt{x}\, dx$
   h. $\int_{-8}^{0} \frac{1}{\sqrt{1-x}}\, dx$
3. Compute $\int_a^b f(x)\, dx$ if F'(x) = f(x).
4. Give an antiderivative of f(x) = cos(3x) whose graph has y-intercept 3.

5. Compute:

a. $\frac{d}{dx}\int_0^{2-3x} \sin(3t^3)\,dt$

b. $\frac{d}{dx}\int_{-2x}^{1} \cos(2t^2+1)\,dt$

c. $\frac{d}{dx}\int_{4x^2}^{3-5x} \sqrt{t+1}\,dt$

6. Given $F(x) = \int_3^{x^2} (t+2)\,dt$, find:

a. $F(\sqrt{3})$

b. $F'(2)$

7. The function f(x) given below is continuous, find a formula for f(x):

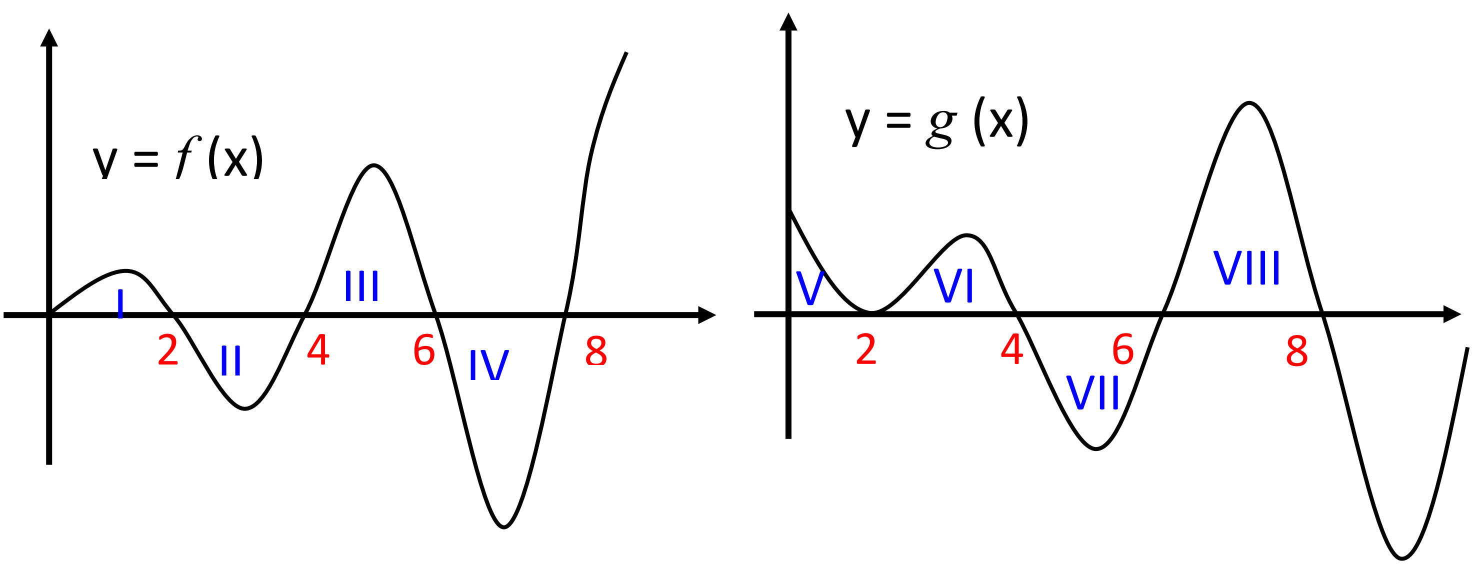
a. $\int_x^2 (t+1)\,f(t)\,dt = \sin x$

b. $-2x^4 - 3x^2 - 6 = \int_2^x \frac{f(t)}{t+2}\,dt$

8. The graphs of *f* and *g* are shown.

Regions I, II, III and IV have areas 1, 3, 5 and 7 respectively.

Regions V, VI, VII and VIII have areas 1, 3/2, 5/2 and 5 respectively.



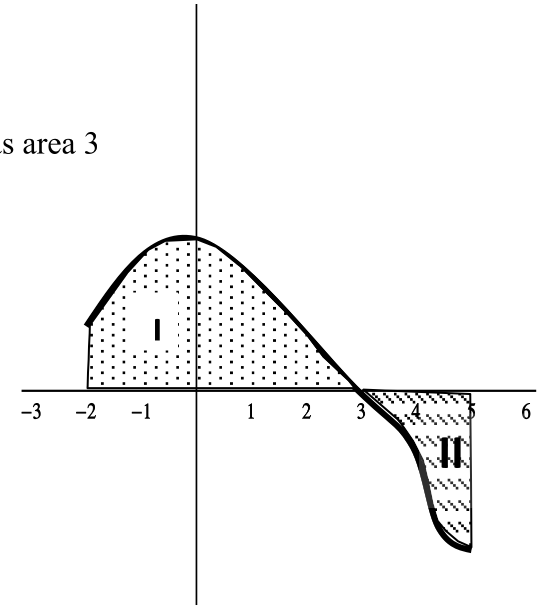
Give:

a. $\int_2^8 \left(f(x) + 2g(x)\right)dx$.

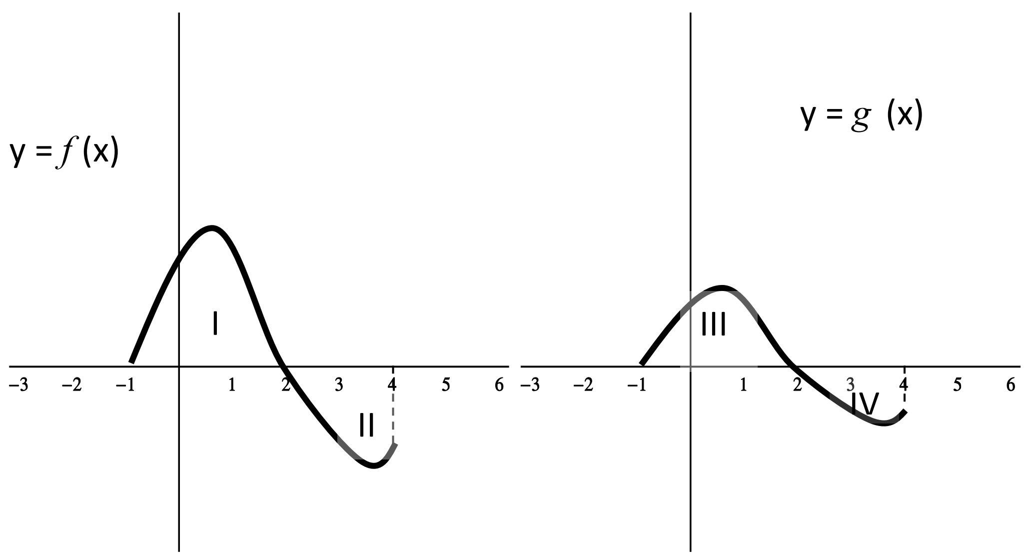
b. $\int_0^6 \left(f(x) - g(x)\right)dx$

9. The graph of y = f(x) is shown. The region II has area 3 and $\int_{-2}^{5} f(x)dx = 2$.

Give the area of region I



10. Graphs of y = f(x) and y = g (x) are shown. The areas of regions I, II, III and IV are 2, 3, 1 and 2 respectively. Give $\int_{-1}^{4}(-2f(x)+3g(x))\,dx$



11. Give both the **upper** and **lower** Riemann sums for the function $f(x) = -x^3 + 12$ over the interval [–2, 2] with respect to the partition P = {–2, 0, 1, 2}.
12. Give the Riemann sum for the function $f(x) = 4 - x^2$ over the interval [–2, 2] with respect to the partition P = {–2, –1, 0, 1, 2} using midpoints.
13. Give the Riemann sum for the function $f(x) = 4 - x^2$ over the interval [–2, 2] with respect to the partition P = {–2, –1, 0, 1, 2} using left hand endpoints.
14. Give the equation for the tangent and normal to the curve: $f(x) = \ln(2x-5) + e^{x-3}$ at the point (3,1).

15. The management of a large store has 1600 feet of fencing to enclose a rectangular storage yard using the building as one side of the yard. If the fencing is used for the remaining 3 sides, find the area of the largest possible yard.
16. Of all the rectangles with an area of 400 square feet, find the dimensions of the one with the smallest perimeter.
17. Find the coordinates of the point(s) on the curve $8y = 40 - x^2$ that are closest to the origin.
18. Maximize the volume of a box, open at the top, which has a square base and which is composed of 600 square inches of material. Let x represent each dimension of the base and let y represent the height of the box.
19. Use differentials to approximate $\sqrt{63}$.
20. Give the differential of $f(x) = x^2 - 3x$ at $x = 1$ with respect to the increment $1/10$.
21. Estimate $\tan(28^\circ)$ using differentials.
22. In each of the following, determine whether or not L'Hopital's Rule applies. If it applies, state the indeterminate form then find the limit.

a. $\lim\limits_{x \to 0} \dfrac{1 + x - e^x}{x^2}$

b. $\lim\limits_{x \to 1} \dfrac{x + \ln x}{2x^2}$

c. $\lim\limits_{x \to \infty} \left(1 + \dfrac{2}{x}\right)^{2x}$

d. $\lim\limits_{x \to 0} \dfrac{1 - \cos x}{x^2}$

e. $\lim\limits_{n \to \infty} \dfrac{\ln(n+4)}{n+2}$

f. $\lim\limits_{n \to \infty} (3n)^{\frac{2}{n}}$

g. $\lim\limits_{n \to \infty} \left(1 + \dfrac{3}{n}\right)^{2n}$

h. $\lim\limits_{x \to \infty} \dfrac{x^2}{\ln x}$

i. $\lim\limits_{x \to \infty} \left(e^{3x} + 1\right)^{\frac{1}{2x}}$

j. $\lim\limits_{x \to 0} \dfrac{\arctan(4x)}{x}$