Math 2320 - Test 1 Review

§1.1-§2.3

1 Riemann Sums

1. Use the RH Rule to approximate the indicated integral.
   (a) $f(x) = x^2 + 1$, $n = 4$, $a = 1$, $b = 5$
   (b) $f(x) = x^3 - 1$, $n = 4$, $a = -1$, $b = 1$
   (c) $f(x) = 3x + 1$, $n = 10$, $a = 0$, $b = 5$

2 FTC

2. Use the FTC to compute
   (a) $\frac{d}{dx}\left[\int_1^x e^{t^2} dt\right]$
   (b) $\frac{d}{dx}\left[\int_x^2 f(t) dt\right]$
   (c) $\frac{d}{dx}\left[\int_1^{x^3} e^{t^2} dt\right]$
   (d) $\frac{d}{dx}\left[\int_x^{2x} e^{t^2} dt\right]$

3 Integrals

3. $\int \frac{x^2 - 1}{x} dx$
4. $\int \cos(x) dx$
5. $\int \frac{1}{1 + x^2} dx$
6. $\int \frac{1}{\sqrt{1 - x^2}} dx$

7. $\int (4x^3 - 2)^{1/3} x^2 dx$ u-sub

8. $\int e^{(4x^3-2)} x^2 dx$ u-sub

9. $\int \cos(4x^3 - 2) x^2 dx$ u-sub

10. $\int \frac{1}{x \ln(x)} dx$ u-sub

11. $\int \frac{\sin(x)}{\cos(x)} dx$ u-sub

12. $\int \frac{\sec^2(x)}{\sqrt{\tan(x)}} dx$ u-sub

13. $\int \frac{e^x}{1+e^x} dx$ u-sub

14. $\int \frac{e^x}{1+e^{2x}} dx$ u-sub

15. $\int \frac{1}{\sqrt{1-4x^2}} dx$ u-sub, let $u = 2x$

4 Area between curves and Volume

16. Find the area of the indicated region.
    (a) between $f(x) = x^2$, $f(x) = 1 - x^2$
    (b) below $y = e^x$ above the line $y = 1$ and to the left of $y = 4$.
    (c) below $y = \ln(x)$ above the x-axis and to the left of $y = 4$.
    (d) between $x = y^2$, $y = x - 2$

17. Find the volume of the indicated region using method of slicing.
    (a) between $y = x^2$, $y = 14$ and to the right of the y-axis revolved about the x-axis.
    (b) between $y = x^2$, $y = 14$ and to the right of the y-axis revolved about the y-axis.

(c) between $f(x) = x^2$, $f(x) = 1 - x^2$ revolved about the x-axis

(d) below $y = e^x$ above the line $y = 1$ and to the left of $y = 4$.

(e) below $y = \ln(x)$ above the x-axis and to the left of $y = 4$.

(f) between $x = y^2$, $y = x - 2$ revolved about the y-axis.

18. Find the volume of the indicated region using method of shells.

    (a) between $y = x^2$, $y = 14$ and to the right of the y-axis revolved about the x-axis.

    (b) between $y = x^2$, $y = 14$ and to the right of the y-axis revolved about the y-axis.

    (c) the region above $f(x) = e^{x^2}$, below $y = 7$ and in the first quadrant revolved about the y-axis.

    (d) between $f(x) = x^2$, $f(x) = 1 - x^2$

    (e) below $y = e^x$ above the line $y = 1$ and to the left of $y = 4$.

    (f) below $y = \ln(x)$ above the x-axis and to the left of $y = 4$.

    (g) between $x = y^2$, $y = x - 2$ and the x-axis revolved about the x-axis.

5 Arc Length

19. Find the arclength from $x = 1$ to $x = 2$ for $y = 3x - 1$.

20. Find the arclength from the point $(0, 2)$ to $(1, 7)$ for $y = 5x + 2$.

21. Set up the integral (do not solve) to find the arclength from the point $(-2, 0)$ to $(2, 0)$ for $y = \sqrt{4 - x^2}$.

6 Techniques of Integration

22. $\displaystyle\int \frac{x}{x^2 - 1} dx$

23. $\displaystyle\int \frac{e^x}{1 + e^x} dx$

24. $\displaystyle\int \frac{e^x}{1 + e^{2x}} dx$

25. $\int \frac{\ln(x)}{x} dx$

26. $\int x \ln(x) dx$

27. $\int x^2 e^x dx$

28. $\int \arctan(x) dx$

29. $\int \ln(x) dx$

30. $\int x \sin(2x) dx$

31. $\int \sin^2(3x) \cos(3x) dx$

32. $\int \sin^2(3x) \cos^3(3x) dx$

33. $\int \sin^2(3x) dx$

34. $\int \sin^2(4x) \cos^2(4x) dx$

35. $\int \tan^3(x) \sec^2(x) dx$

36. $\int \frac{1}{\sqrt{4 - 9x^2}} dx$

37. $\int \frac{1}{4 + 9x^2} dx$

38. $\int \frac{1}{(1 - x^2)^{3/2}} dx$

39. $\int \frac{\sqrt{1 + x^2}}{x} dx$

40. $\int \frac{1}{x^2 \sqrt{1 - x^2}} dx$

41. $\int \frac{2x+3}{(x+1)(x+2)}dx$

42. $\int \frac{x^2+x+1}{x^3+x}dx$

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

44. $\int \frac{2x-1}{(x^2+1)(x-1)}dx$

45. $\int \frac{1}{x^3(x^2+1)^2(x-1)^3}dx$ Set up the partial fractions only. Do not solve for A,B,.... or integrate.

46. $\int_1^\infty \frac{1}{x}dx$

47. $\int_1^\infty \frac{1}{x^2}dx$

48. $\int_1^\infty \frac{1}{x^{1/2}}dx$

49. $\int_0^1 \frac{1}{x}dx$

50. $\int_0^1 \frac{1}{x^2}dx$

51. $\int_0^1 \frac{1}{x^{1/2}}dx$

52. $\int_1^\infty xe^{-x}dx$

53. $\int_0^1 \ln(x)dx$