Philip Dumaresq **D**

WeBWorK assignment due : 03/03/2019 at 11:59pm EST.

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1. (1 point) Use the Midpoint Rule to approximate

$$\int_{-2.5}^{4.5} x^3 dx$$

with $n = 7$.

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2. (1 point) Consider the function $f(x) = \frac{x^2}{3} - 2$.

In this problem you will calculate $\int_0^4 \left(\frac{x^2}{3} - 2\right) dx$ by using the definition

$$\int_a^b f(x)\,dx = \lim_{n\to\infty} \left[\sum_{i=1}^{n} f(x_i)\Delta x\right]$$

The summation inside the brackets is R_n which is the Riemann sum where the sample points are chosen to be the right-hand endpoints of each sub-interval.

Calculate R_n for $f(x) = \frac{x^2}{3} - 2$ on the interval $[0,4]$ and write your answer as a function of n without any summation signs. You will need the summation formulas on page 383 of your textbook (page 364 in older texts).

$R_n =$ ________________

$\lim_{n\to\infty} R_n =$ ____________

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3. (1 point) Let $\int_{-4}^{5} f(x)dx = 2$, $\int_{-4}^{-1} f(x)dx = 2$, $\int_{2}^{5} f(x)dx = 4$.

Find $\int_{-1}^{2} f(x)dx =$ ____

and $\int_{2}^{-1} (2f(x)-2)dx =$ ____

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4. (1 point) If $f(x) = \int_3^{x^2} t^5 dt$

then

$f'(x) =$ ____________

$f'(5) =$ ____________

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5. (1 point) Given

$$f(x) = \int_0^x \frac{t^2 - 36}{1+\cos^2(t)} dt$$

At what value of x does the local max of $f(x)$ occur?

$x =$ ________

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6. (1 point) Evaluate the definite integral.

$\int_0^1 x^2 \sqrt[7]{e^x}\, dx =$ ____________________

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7. (1 point) Evaluate the definite integral.

$\int_1^7 \sqrt{t}\ln(t)\, dt =$ ____________________

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8. (1 point) Use the Fundamental Theorem of Calculus to carry out the following differentiation:

$\frac{\mathrm{d}}{\mathrm{d}x}\int_1^{\sqrt{x}} t^t \,\mathrm{d}t =$ __________.

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9. (1 point) **Integration by Parts:** This is the most important integration technique we've discussed in this class. It has a wide range of applications beyond increasing our list of integration rules.

$\int z^3 \ln z \mathrm{d}z =$ ________________.

$\int e^t \cos t \mathrm{d}t =$ ________________.

$\int_0^{2\pi} \sin(x)\sin(x+1)\mathrm{d}x =$ ________________.

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10. (1 point) Use integration by parts to evaluate the integral.

$$\int xe^{4x} dx$$

Answer: ________________________ $+C$

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11. (1 point) Use integration by parts to evaluate the definite integral.

$$\int_1^6 \sqrt{t}\ln t\, dt$$

Answer: ________________________

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12. (1 point) Evaluate the definite integral.

$$\int_1^8 \ln x^{30} dx$$

Answer: ________________________

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13. (1 point) Evaluate the indefinite integral.

$$\int \ln(x^2 + 18x + 77)dx$$

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14. (1 point)

Definition: The AREA A of the region S that lies under the graph of the continuous function f is the limit of the sum of the areas of approximating rectangles

$$A = \lim_{n\to\infty} R_n = \lim_{n\to\infty} [f(x_1)\Delta x + f(x_2)\Delta x + ... + f(x_n)\Delta x]$$

Consider the function $f(x) = \dfrac{\ln(x)}{x}, \quad 3 \le x \le 10$. Using the above definition, determine which of the following expressions represents the area under the graph of f as a limit.

- A. $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{10}{n} \frac{\ln(3+\frac{10i}{n})}{3+\frac{10i}{n}}$
- B. $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{7}{n} \frac{\ln(3+\frac{7i}{n})}{3+\frac{7i}{n}}$
- C. $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{7}{n} \frac{\ln(\frac{7i}{n})}{\frac{7i}{n}}$
- D. $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{10}{n} \frac{\ln(\frac{10i}{n})}{\frac{10i}{n}}$
- E. $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{\ln(3+\frac{7i}{n})}{3+\frac{7i}{n}}$

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15. (1 point)

Definition: The AREA A of the region S that lies under the graph of the continuous function f is the limit of the sum of the areas of approximating rectangles

$$A = \lim_{n\to\infty} R_n = \lim_{n\to\infty} [f(x_1)\Delta x + f(x_2)\Delta x + ... + f(x_n)\Delta x]$$

(a) Use the above Definition to determine which of the following expressions represents the area under the graph of $f(x) = x^3$ from $x = 0$ to $x = 1$.

- A. $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{i}{n}\right) \frac{1}{n}$
- B. $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{i}{n}\right)^3 \frac{5}{n}$
- C. $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{i}{n}\right) \frac{5}{n}$
- D. $\lim_{n\to\infty} \sum_{i=1}^{n} \left(\frac{i}{n}\right)^3 \frac{1}{n}$

(b) Evaluate the limit that is the correct answer to part (a). You may find the following formula for the sum of cubes helpful:

$$1^3 + 2^3 + 3^3 + ... + n^3 = \sum_{i=1}^{n} i^3 = \left(\frac{n(n+1)}{2}\right)^2.$$

Value of limit = ________________

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16. (1 point)

Find the derivative of $f(x) = x\sin(x) + \cos(x) + C$ to complete the following integration formula:

$\int$ ________________ $dx = x\sin(x) + \cos(x) + C$

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17. (1 point)

Using an upper-case "C" for any arbitrary constants, find the general indefinite integral

$$\int 8x^{-3/4} dx$$

Integral = ________________

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18. (1 point)

Using an upper-case "C" for any arbitrary constants, find the general indefinite integral

$$\int (-10x^3 - 1x - 10)\, dx$$

Integral = ________________

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19. (1 point)

Using an upper-case "C" for any arbitrary constants, find the general indefinite integral

$$\int (2 - \sqrt{x})^2\, dx$$

Integral = ________________

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20. (1 point)

Evaluate the integral

$$\int_1^2 \frac{5y + 1y^7}{y^3}\, dy$$

Integral = ________________

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21. (1 point)

Evaluate the integral

$$\int_1^9 \frac{5x - 10}{\sqrt{x}}\, dx$$

Integral = ________________

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22. (1 point)

Evaluate the integral

$$\int_4^9 \left(-1\sqrt{x} + \frac{5}{\sqrt{x}}\right)^2 dx$$

Integral = ________________

23. (1 point)
Evaluate the following integral by making the given substitution:

$$\int x^2\sqrt{x^3+8}\,dx, \quad u = x^3+8$$

Note: Any arbitrary constants used must be an upper-case "C".

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24. (1 point)
Evaluate the following integral by making the given substitution:

$$\int \frac{-9\sin(\sqrt{x})}{\sqrt{x}}\,dx, \quad u = \sqrt{x}$$

Note: Any arbitrary constants used must be an upper-case "C".

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25. (1 point)
Evaluate the indefinite integral

$$\int -2(2-x)^6\,dx$$

Note: Any arbitrary constants used must be an upper-case "C".

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26. (1 point)
Evaluate the indefinite integral

$$\int \frac{-3(\ln(x))^2}{x}\,dx$$

Note: Any arbitrary constants used must be an upper-case "C".

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27. (1 point)
Evaluate the indefinite integral

$$\int -7\sqrt[3]{x^3+1}\,x^5\,dx$$

Note: Any arbitrary constants used must be an upper-case "C".

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28. (1 point)
Evaluate the definite integral (if it exists)

$$\int_0^4 \frac{-5x}{\sqrt{1+2x}}\,dx$$

If the integral does not exist, type "DNE".

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29. (1 point)
Find the average value of the function $g(x) = -4x^2\sqrt{1+x^3}$ on the interval [0, 2].
g_{ave} = ______________

30. (1 point)
Find the average value of the function $f(t) = -2\sec(t)\tan(t)$ on the interval $[0, \pi/4]$.
f_{ave} = ______________

31. (1 point)
Evaluate the integral

$$\int_{\pi/2}^{3\pi/4} -4\sin^5(x)\cos^3(x)\,dx$$

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32. (1 point)
Evaluate the integral

$$\int_0^{\pi/2} -10\cos^2(x)\,dx$$

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33. (1 point)
Evaluate the integral

$$\int_0^{\pi/2} 2\sec^4(t/2)\,dt$$

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34. (1 point)
Evaluate the integral

$$\int -2\tan^4(x)\,dx$$

Note: Use an upper-case "C" for the constant of integration.

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35. (1 point)
Evaluate the integral

$$\int -3\sin(3x)\cos(x)\,dx$$

Note: Use an upper-case "C" for the constant of integration.

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36. (1 point)
Evaluate the integral

$$\int_0^{2\sqrt{3}} \frac{5x^3}{\sqrt{16-x^2}}\,dx$$

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37. (1 point)
Evaluate the integral

$$\int \frac{7}{x^2\sqrt{25-x^2}}\,dx$$

Note: Use an upper-case "C" for the constant of integration.

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38. (1 point)
Evaluate the integral

$$\int \frac{-6}{x^2\sqrt{16x^2-9}}\,dx$$

Note: Use an upper-case "C" for the constant of integration.

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39. (1 point)
Evaluate the integral

$$\int -10\sqrt{5+4x-x^2}\,dx$$

Note: Use an upper-case "C" for the constant of integration.
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40. (1 point)
Which of the following is the correct form of the partial fraction decomposition of $\frac{x^4}{x^4-1}$?

- A. $1+\frac{A}{x+1}+\frac{B}{x-1}+\frac{Cx+D}{x^2+1}$
- B. $-1+\frac{A}{x+1}+\frac{B}{x-1}+\frac{C}{x^2+1}$
- C. $-1+\frac{A}{x+1}+\frac{B}{x-1}+\frac{Cx+D}{x^2+1}$
- D. $1+\frac{A}{x+1}+\frac{B}{x-1}+\frac{C}{x^2+1}$

41. (1 point)
Evaluate the integral

$$\int_0^1 \frac{1x-1}{x^2+3x+2}\,dx$$

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42. (1 point)
Evaluate the integral

$$\int \frac{10x^2}{(x+1)^3}\,dx$$

Note: Use an upper-case "C" for the constant of integration.
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43. (1 point) Calculate the following antiderivatives:
(a) $\int 13t-2t^5-9\,dt =$ ______________ $+C$.
(b) $\int \frac{1}{u^{5/4}}+5.5\sqrt{u}\,du =$ ______________ $+C$.
(c) $\int \frac{1}{5x^6}\,dx =$ ______________ $+C$.

44. (1 point) Evaluate the indefinite integral.
$\int 3\sec^2 x-2e^x\,dx =$ ______________ $+C$.

45. (1 point) Evaluate the integral by interpreting it in terms of areas. In other words, draw a picture of the region the integral represents, and find the area using high school geometry.

$$\int_0^9 |9x-2|\,dx$$

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46. (1 point) In a certain city the temperature (in degrees Fahrenheit) t hours after 9am was approximated by the function

$$T(t)=80+13\sin\left(\frac{\pi t}{12}\right)$$

Determine the temperature at 9 am. _____
Determine the temperature at 3 pm. _____

Find the average temperature during the period from 9 am to 9 pm. ______________

47. (1 point)
Find the average value of the function $h(r)=-27/(1+r)^2$ on the interval [1, 6].
$h_{ave} =$ ______________

48. (1 point)
Find the average value of the function $f(t)=-4te^{-t^2}$ on the interval [0, 5].
$f_{ave} =$ ______________