Faculty Report on CASLO Evidence

Program: Natural Sciences

Course: MATH 207

CASLO Focus:

- ☐ Critical Thinking
- ☐ Oral Communication
- ☐ Information Literacy
- ☐ Written Communication
- ☐ Creativity
- ☑ Quantitative Reasoning

Student sample has been rated:

- ☑ Exemplary level
- ☐ Minimal level

Your course has been selected for this activity because it requires students to demonstrate exit-level proficiency for the indicated program and CASLO. Please consider the following guidelines as you select appropriate evidence of student learning for this activity:

- Select two samples of student work, one that demonstrates exemplary achievement of the CASLO and another that demonstrates achievement at (or near) the minimal level required for the degree. Choose evidence from an "embedded" assignment, project, or exam that normally exists as part of your course.
- Review the statements associated with the relevant CASLO standard (see attached) to assure that the evidence correlates adequately with the CASLO. In general, choose evidence which corresponds to at least fifty percent of the outcome statements.
- Select evidence produced with an appropriate degree of independence. In general, student work directed by prescriptive advice is not appropriate for this activity.

Please briefly describe your assessment of the evidence; identify qualities in the student work that establish its level of achievement for the CASLO:

Outcome 2.1: On Final Exam question 9, the student uses a calculus technique to estimate the area under a curve. He shows all the steps clearly and performs all calculations accurately to find the correct answer.

Outcome 2.2: On Final Exam question 10, the student represents mathematical information effectively by first sketching a graph of a function and then using this graph to correctly determine an area.

Outcome 2.3: On Final Exam question 6, Students are presented with a table of information about the velocity of a moving object. This student interprets the information in the table correctly and as a result finds the distance traveled by the object using calculus. This ability will allow this student to calculate distance, velocity in a variety of applications. Although the student does not show his work sufficiently to justify the correct answer in this instance, he does so consistently throughout the rest of the exam.

Outcome 2.4: On the Final Exam question 3. Students are presented with a multi-layered problem. In order to solve it, this student must first finds the average value of the given function and then equates the average value with the function itself. As as a result, the student finds the correct input values. Lastly this students establishes that the results fits within the given interval.

Continue on next page.

Outcome 2.5: While students are asked to demonstrate understanding of quantitative evidence as referenced above, they are not required to use it to support an argument or method.

Please briefly describe course work designed to prepare this student to demonstrate this CASLO:

Outcome 2.1: From day one and throughout the semester accurate calculation is modelled by the instructor and fellow students during class time. Throughout the semester students complete several modules via MyMathLab to reinforce calculation skills. The computer based instruction provides instant feedback on accuracy and built-in help resources. Students who are having difficulties are encouraged to interact with the instructor through email or office hours.

Outcome 2.2: Throughout the semester, representation of mathematical information as graphs, tables, words, and equations is modelled by the instructor and fellow students during class time. Throughout the semester students complete several modules via MyMathLab to reinforce these skills. The computer based instruction provides instant feedback on accuracy and built in "help" resources. Students who are having difficulties are encouraged to interact with the instructor through email or office hours.

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Outcome 2.4: Throughout the semester, the instructor models analysis of quantitative data. These skills are further developed through course group projects in which students apply these skills to various problems. Some of the MyMathLab questions further develop and test this ability. The computer based instruction provides instant feedback on accuracy and built in "help" resources. Students who are having difficulties are encouraged to interact with the instructor through email or office hours.

Outcome 2.5: While students are asked to demonstrate understanding of quantitative evidence as referenced above, they are not required to use it to support an argument or method.

MATH 205 Exam- May 2014

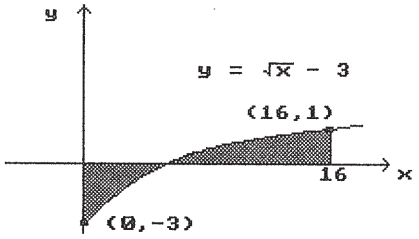
105 Minutes- Open Book/Notes

Please do not detach the pages

Name_____

Find the area of the shaded region.

1)



Find the derivative.

2) $y = \int_{x^{10}}^{0} \cos\sqrt{t}\, dt$

Find the point(s) at which the given function equals its average value on the given interval.

3) $f(x) = 1 - x^2; [-6, 3]$

Use the substitution formula to evaluate the integral.

4) $\int_{0}^{\pi} (1 + \cos 5t)^2 \sin 5t\, dt$

Solve the problem.

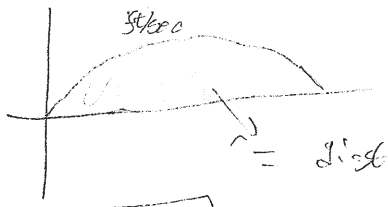
5) Suppose that g is continuous and that $\int_{3}^{5} g(x)\, dx = 11$ and $\int_{3}^{9} g(x)\, dx = 17$. Find $\int_{9}^{5} g(x)\, dx$.

Estimate the value of the quantity.

6) A piece of tissue paper is picked up in gusty wind. The table shows the velocity of the paper at 2 second intervals. Estimate the distance the paper travelled using **left-endpoints**.

Time (sec)	Velocity (ft/sec)
0	0
2	8
4	12
6	6
8	20
10	25
12	15
14	10
16	2

Left = 96



= distance traveled

96 feet

1/2

Evaluate the integral.

7) $\int 9x^2 \sqrt[4]{11 + 4x^3}\, dx$

2

Express the sum in sigma notation.

8) $1 - 2 + 4 - 8 + 16$

2

Use a finite approximation to estimate the area under the graph of the given function on the stated interval as instructed.

9) $f(x) = x^2$ between $x = 0$ and $x = 4$ using the midpoint sum with two rectangles of equal width.

3

Graph the integrand and *use geometry* to evaluate the integral.

10) $\int_{-3}^{7} |x|\, dx$

2

19/20

Very good!

$y = \sqrt{x} - 3$ from $(0, 16)$

1. $0 = \sqrt{x} - 3$ x-int: $(9, 0)$

$3 = \sqrt{x}$

$9 = x$

$$\int_0^9 + \int_9^{16} = \text{Total Area}$$

	Left	Mid	Right	Actual
$\int_0^9$	9.1405	8.99841	8.8705	$9 = \frac{27}{3}$
$\int_9^{16}$	3.63165	3.66668	3.70165	$3\frac{2}{3} = \frac{11}{3}$
$\int_0^{16}$	12.77215	12.66509	12.57215	$\frac{38}{3}$ units^2 Total Area
				12.66667

check: $\int \sqrt{x} - 3 \, dx = \frac{2}{3}x^{\frac{3}{2}} - 3x + C$

2.) $\int_{x^{10}}^{0} \cos\sqrt{t}\, dt = -\int_{0}^{x^{10}} \cos\sqrt{t}\, dt$

$$\int_{0}^{x^{10}} \cos\sqrt{t}\, dt = 10x^9\left(\cos\sqrt{x^{10}}\right) - 0'\left(\cos\sqrt{0}\right)$$

$$= 10x^9\cos(x^5)$$

$$\boxed{-10x^9\cos(x^5)}$$

3.) $f(x) = 1 - x^2 \; ; \; [-6, 3]$

$$\bar{f} = \frac{\int_{-6}^{3} (1-x^2)\,dx}{9} = \frac{\left(x - \frac{x^3}{3}\right)\Big|_{-6}^{3}}{9} = -5$$

Let $u = 1 - x^2$

$$\frac{du}{dx} = -2x = -2\sqrt{1-u}$$

$$dx = \frac{du}{-2x} = \frac{du}{-2\sqrt{1-u}}$$

$$x = \sqrt{1-u}$$

$$1 - (-6)^2 = -35$$

$$1 - (3)^2 = -8$$

$$\frac{\int_{-35}^{-8} (u)\left(\frac{du}{-2\sqrt{1-u}}\right)}{9}$$

unnecessary when you can find the exact solution directly

$$\frac{\frac{1}{3}\sqrt{1-u}\,(u+2)}{9}\Bigg|_{-35}^{-8}$$

$$\frac{\frac{1}{3}\sqrt{-26}\,(-33)}{9} - \frac{\frac{1}{3}\sqrt{36}\,(-6)}{9}$$

$$u = 1 - x^2$$

$$x^2 = 1 - u$$

$$x = \sqrt{1-u}$$

$$\bar{f} = -\frac{72}{9} = -8$$

$$1 - x^2 = -8$$

$$x^2 = 9$$

$$\boxed{x = \pm 3}$$

4.) $\int_0^{\pi} (1+\cos(5t))^2 \sin 5t \, dt$

let $u = 1+\cos(5t)$

$\frac{du}{dt} = -5\sin(5t)$

$dt = \frac{du}{-5\sin(5t)}$

$0 \to 1+\cos(0) = 2$

$\pi \to 1+\cos(5\pi) = 0$

$$2\int^{0} u^2 \frac{(\sin(5t))\, du}{-5\sin(5t)}$$

$$-\frac{1}{5} \, 2\int^{0} u^2 \, du$$

$$-\frac{u^3}{15}\Big|_2^0$$

$$-\frac{0^3}{15} = 0$$

$$-\frac{2^3}{15} = -\frac{8}{15}$$

$$0 - \left(-\frac{8}{15}\right) = \boxed{\frac{8}{15}}$$

5.) $\int_3^5 g(x)\,dx = 11$ $\int_3^9 g(x)\,dx = 17$

$$\int_9^5 g(x)\,dx = -6$$ ★

$17 - 11 = \int_5^9 = 6$

$-\int_5^9 = \int_9^5 = -6$

6.)

96 feet

Rationalization by Question

Show your work completely!!

7.) $\int 9x^2(11+4x^3)^{\frac{1}{4}}\,dx$

$$\frac{3}{5}(4x^3+11)^{5/4}+C$$

$9\int x^2(11+4x^3)^{1/4}$ $u\cdot u'$

$\int x^2(11+4x^3)^{1/4} \rightarrow \frac{3}{15}(4x^3+11)^{5/4}$

$\rightarrow \frac{2}{15}(4x^3+11)^{5/4}$

$\frac{3}{5}(4x^3+11)^{5/4}$

$(4x^3+11)^{1/4}{}'$

$\frac{1}{4}(4x^3+11)^{-3/4}(12x^2)$

$\frac{1}{(x^3+11)^{3/4}}$

8.) $1-2+4-8+16$

$$\sum_{n=1}^{5} (-1)^{n+1}\left[2^{n-1}\right]$$

$1+2+4+8+16$

$\frac{n}{n^2}$

	$1 \times \frac{1}{1}$
1×1	
1×2	$1 \times \frac{1}{.5}$
1×4	$1 \times \frac{1}{.25}$
1×8	$1 \times \frac{1}{.125}$
1×16	$1 \times \frac{1}{.0625}$

n^2

1	2	4	8	16
1	2	3	4	5

All exponents of 2

2^{n-1}

2^{1-1}	2^{2-1}	2^{3-1}	2^{4-1}	2^{5-1}
0	1	4	8	16

$$\sum_{n=1}^{5} (-1)^{n-1}(2^{n-1})$$

$$\sum_{n=1}^{5} (-2)^{n-1}$$

9.) $f(x) = x^2$ $[0, 4]$

$$\sum_{k=1}^{n} f\left(a + \frac{2k-1}{2}\Delta x\right)\Delta x$$

$$\Delta x = \frac{b-a}{n} = \frac{4}{2} = 2$$

$$\sum_{k=1}^{2} f\left(0 + \frac{2k-1}{2}(2)\right)2$$

$k=1 = f(2-1),(2)$

$= 1^2(2)$

$= 2$

$k=2 = f(4-1)(2)$

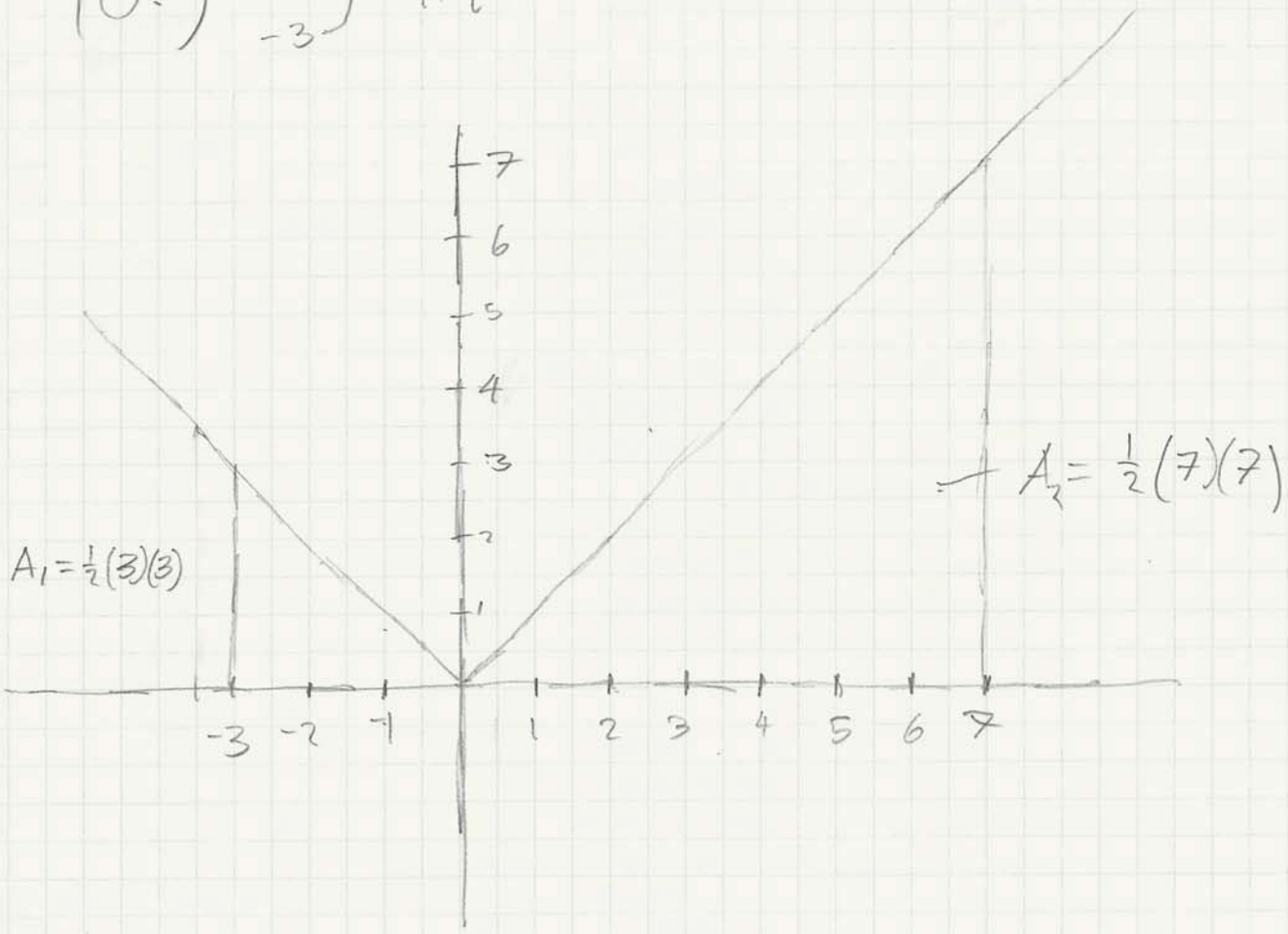
$= f(3)(2$

$= 3^2(2)$

$= 18$

$18+2 = \boxed{20 \text{ units}^2}$

10.) $\int_{-3}^{7} |x|\,dx$



$A_{total} = A_1 + A_2$

$= 4.5 + 24.5$

$A_{total} = 29 \text{ units}^2$

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Outcome 2.1: On Final Exam question 9, the student uses a calculus technique to estimate the area under a curve. Her response suggests a limited ability to properly interpret what the questions has asked. She shows all the steps clearly and performs all calculations accurately despite an incorrect initial assumption.

Outcome 2.2: On Final Exam question 1, the student correctly sets up integrals using the given graph to determine the specified area. However, she evaluates the result incorrectly and gets a negative value for the area which is impossible. She declares that negative value as her final answer.

Outcome 2.3: On Final Exam question 8, the student is not able to find the existing pattern of a given sum. Because of that, she cannot write the sum in a closed form using sigma notation as required.

Outcome 2.4: On Final Exam question 3. Students are presented with a multi-layered problem. In order to solve it, this student must first find the average value of the given function and then equates the average value with the function itself. This student does not find all possible results of that step, and thus cannot discuss which results are acceptable.

Continue on next page.

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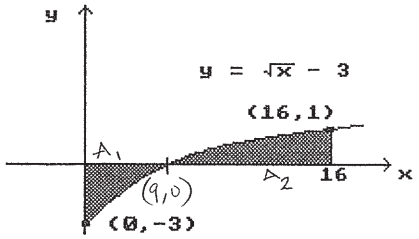

1/3

Find the derivative.

2) $y = \int_{x^8}^{0} \cos\sqrt{t}\, dt$

1/2

Find the point(s) at which the given function equals its average value on the given interval.

3) $f(x) = 4 - x^2$; $[-3, 6]$

1.5/3

Use the substitution formula to evaluate the integral.

4) $\int_{0}^{\pi} (1 + \cos 7t)^2 \sin 7t\, dt$

2

Solve the problem.

5) Suppose that g is continuous and that $\int_{3}^{5} g(x)\, dx = 5$ and $\int_{3}^{8} g(x)\, dx = 18$. Find $\int_{8}^{5} g(x)\, dx$.

2

Estimate the value of the quantity.

6) A piece of tissue paper is picked up in gusty wind. The table shows the velocity of the paper at 2 second intervals. Estimate the distance the paper travelled using **left-endpoints**.

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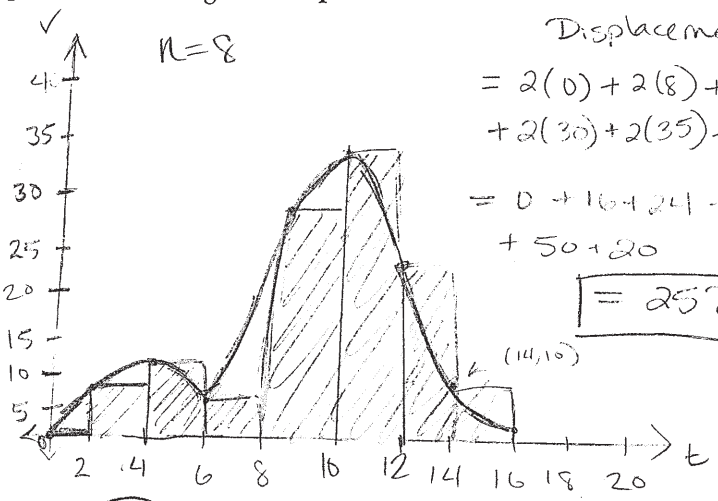


Displacement = area
$= 2(0) + 2(8) + 2(12) + 2(6) + 2(30) + 2(35) + 2(25) + 2(10)$
$= 0 + 16 + 24 + 12 + 60 + 70 + 50 + 20$
$= 252$

$\approx$ 2

2

Evaluate the integral.

7) $\int 10x^2 \sqrt[4]{6 + 3x^3}\, dx$

0

Express the sum in sigma notation.

8) $1 - 3 + 9 - 27 + 81$

Use a finite approximation to estimate the area under the graph of the given function on the stated interval as instructed.

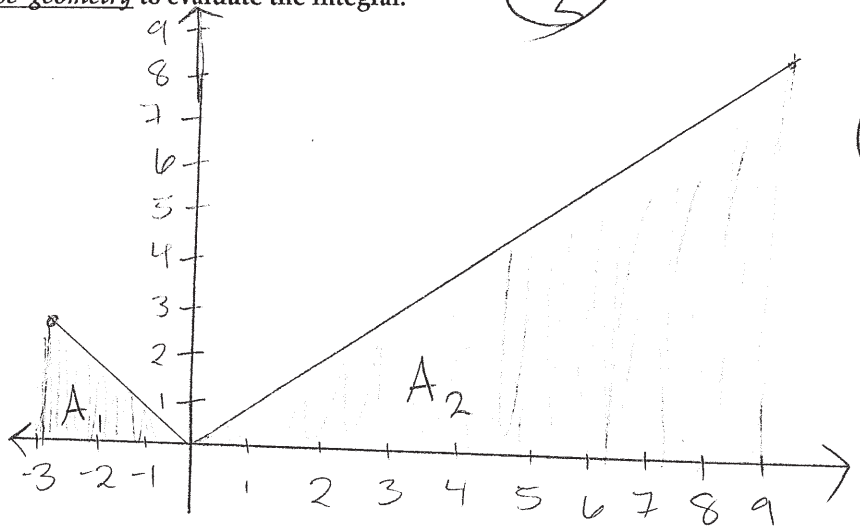
9) $f(x) = x^2$ between $x = 0$ and $x = 3$ using the midpoint sum with two rectangles of equal width.

1/2

Graph the integrand and *use geometry* to evaluate the integral.

10) $\int_{-3}^{9} |x|\, dx$

14.5/20



2

$\int_{-3}^{9} |x|\, dx = A_1 + A_2$

$= \frac{1}{2}(3)(3) + \frac{1}{2}(9)(9)$

$= \frac{9}{2} + \frac{81}{2}$

$= \frac{90}{2} = 45$

1.) $A = A_1 + A_2$

1.) $A = \int_0^9 \sqrt{x} - 3\,dx + \int_9^{16} \sqrt{x} - 3\,dx$

$= \int_0^9 (x^{1/2} - 3)\,dx + \int_9^{16} (x^{1/2} - 3)\,dx$

$= \left(\frac{2}{3}x^{3/2} - 3x\right)\Big|_0^9 + \left(\frac{2}{3}x^{3/2} - 3x\right)\Big|_9^{16}$

$= \frac{2}{3}\sqrt{9^3} - 3(9) - \left(\frac{2}{3}\sqrt{0^3} - 3(0)\right) + \left[\frac{2}{3}\sqrt{16^3} - 3(16) - \left(\frac{2}{3}9\sqrt{9} - 27\right)\right]$

$= \frac{2(9)\sqrt{9}}{3} - 27 + \frac{2(16)\sqrt{16}}{3} - 48 - \frac{18(3)}{3} + 27$

$= \frac{18(9)}{3} - 27 + \frac{32(4)}{3} - 48 - 18 + 27$

$= \frac{128}{3} - \frac{144}{3}$

$\boxed{= \frac{-16}{3}}$

2.) $y = \int_{x^8}^{0} \cos\sqrt{t}\,dt$

$y' = \frac{d}{dx}\int_a^x f(t)\,dt = f(x)$

$y = -\int_0^{x^8} \cos\sqrt{t}\,dt$

$y' = \frac{d}{dx} -\int_0^{x^8} \cos\sqrt{t}\,dt = f(x)$

$y' = \frac{d}{dx}\int_0^{x^8} -\cos\sqrt{t}\,dt = f(x)$

$y' = -\cos\sqrt{x^8}$

3.) $f(x) = 4 - x^2$; $[-3, 6]$

$$4 - x^2 = \frac{1}{6+3} \int_{-3}^{6} (4 - x^2)\, dx$$

$$4 \cdot x^2 = \frac{1}{9} \left(4x - \frac{1}{3}x^3\right)\Big|_{-3}^{6}$$

$$9(4 - x^2) = 4(6) - \frac{1}{3}6^3 - \left(4(-3) - \frac{1}{3}(-3)^3\right)$$

$$36 - 9x^2 = 24 - \frac{216}{3} - \left(-12 + \frac{27}{3}\right)$$

$$36 - 9x^2 = 24 - 72 + 12 - 9$$

$$36 - 9x^2 = -45$$

$$-9x^2 = -81$$

$$\sqrt{x^2} = \sqrt{9} \longrightarrow x = \pm 3$$

$$\boxed{x = 3}$$

$g(t) = u$

$g(t) = 1 + \cos 7t$

$g(\pi) = 1 + \cos(7\pi)$

$= 1 - 1$

$= 0$

$g(0) = 1 + \cos(0)$

$= 1 + 1$

$= 2$

$du = \frac{d}{dt}\cos 7t\, dt$

$du = -\sin 7t \cdot \frac{d}{dt} 7t\, dt$

$du = -7 \sin 7t\, dt$

$\frac{-1}{7} du = \sin 7t\, dt$

4.) $\int_0^{\pi} \underbrace{(1+\cos 7t)^2}_{u} \underbrace{\sin 7t\, dt}_{\frac{-1}{7}du}$

$= \frac{-1}{7} \int_2^0 u^2\, du$

$= \frac{-1}{7} \left(\frac{1}{3}u^3\right)\Big|_2^0$

$= \frac{-1}{7} \left[\frac{1}{3}(0)^3 - \frac{1}{3}(2)^3\right]$

$= \frac{-1}{7}\left(\frac{-8}{3}\right)$

$$\boxed{= \frac{8}{21}}$$

5.) $\int_3^5 g(x)\,dx = 5 \quad + \quad \int_3^8 g(x)\,dx = 18 \qquad \int_8^5 g(x)\,dx = ?$

$\int_3^8 g(x)\,dx - \int_3^5 g(x)\,dx = \int_5^8 g(x)\,dx$

$18 - 5 = \int_5^8 g(x)\,dx$

$13 = \int_5^8 g(x)\,dx$

$-\int_5^8 g(x)\,dx = \int_8^5 g(x)\,dx$

$\int_8^5 g(x)\,dx = -\int_5^8 g(x)\,dx$

$$\boxed{\int_8^5 g(x)\,dx = -13}$$

7.) $\int 10x^2 \sqrt[4]{6+3x^3}\,dx$

$u = 6+3x^3$

$du = 0 + 9x^2\,dx$

$\frac{1}{9}du = x^2\,dx$

$= 10\int x^2 \sqrt[4]{6+3x^3}\,dx$

$= 10\int \underbrace{(6+3x^3)}_{u}{}^{1/4}\ \underbrace{x^2\,dx}_{\frac{1}{9}du}$

$= 10\int u^{1/4}\left(\frac{1}{9}\right)du$

$= \frac{10}{9}\int u^{1/4}\,du$

$= \frac{10}{9}\left(\frac{4}{5}u^{5/4}\right) + C$

$= \frac{40}{45}u^{5/4} + C$

$= \frac{8}{9}u^{5/4} + C$

$$\boxed{= \frac{8}{9}(6+3x^3)^{5/4} + C}$$

8.) $1-3+9-27+81$

$\sum_{k=1}^{4}$

previous number times neg. 3

$1(-3) = -3$

$(-3)(-3) = 9$

$(9)(-3) = -27$

$(-27)(-3) = 81$

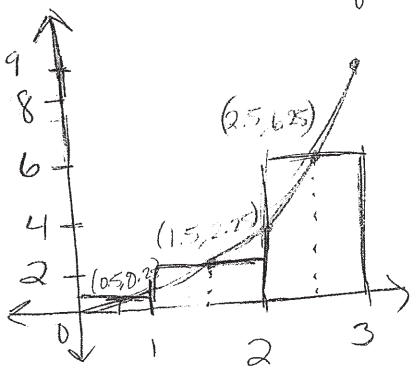
} happens 4 times total

$1-3+9-27+81 = 61$

9.) $f(x) = x^2$ between $x=0$ + $x=3$ using midpoint sum w/ 2 rectangles of equal length

↓ 2 NOT 3

$n=2$ $\int_0^3 x^2\,dx$



x	y
0	0
1	1
2	4
3	9

Midpoints

x	y
0.5	0.25
1.5	2.25
2.5	6.25

$A = 1(0.5)^2 + 1(1.5)^2 + 1(2.5)^2$

$= (0.25) + (2.25) + (6.25)$

$= 8.75 = \frac{35}{4}$