

AMA1007 / AMA1120 (Calculus and Linear Algebra)

Assignment 03

Students should submit their solutions **via Blackboard** :

- (1) Sign the covering declaration statement and write your answers with proper steps (but do not include rough work) within the designated area (i.e., inside the designated boxes). Plan your space properly and do not use any other paper.
- (2) Use **Microsoft Office Lens** on your mobile device to scan page-by-page into one single clear and readable PDF file, (pages must be in sequence following page numbering, and must be one full page per page scan, and all pages must be in the upright portrait orientation). This Microsoft Office Lens app provides an option to save a copy of your PDF file onto your **PolyU Connect OneDrive**, and you can then manipulate the file from your computer. You must not use any other scanner software or any other app other than Microsoft Office Lens. Check the ordering of pages to make sure it is in sequence.
- (3) Make sure your file is of file size no bigger than 3MB, and the
- (4) file name must be student's name with surname first.
- (5) Then, make submissions from your computer (do not make submissions via your mobile device), submissions must be made **by 5:00pm** on the due date to **Blackboard**.

Solutions with detailed workings, presented in a clear, decent, formal, precise and concise mathematical way, in simple but grammatically correct English are required. Sketch diagrams whenever necessary.

Covering declaration

By submitting this work through the online system, I affirm on my honour that I am aware of the Regulations on Academic Integrity in Student Handbook and

- (i) have not given nor received any unauthorized aid to/from any person or persons, and
- (ii) have not used any unauthorized materials in completing my answers to this submission.

Signature: _____

Name : _____

Student Number _____

Question 1

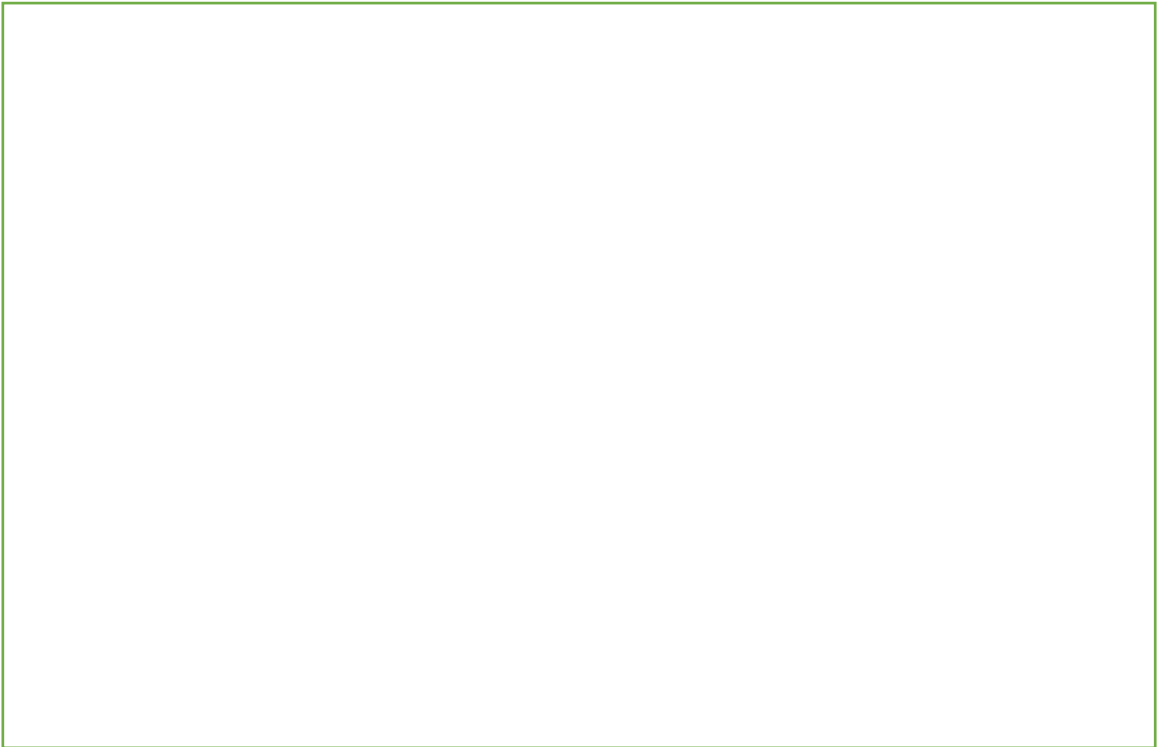
Evaluate the following integral:

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

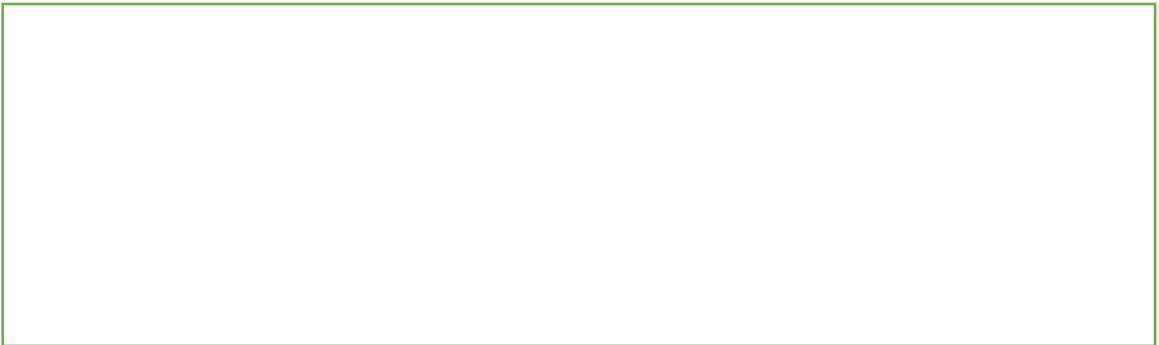
(b) $\int \sin 5x \cos 3x dx$

(c) $\int \frac{1}{x^2 - 8x + 15} dx$

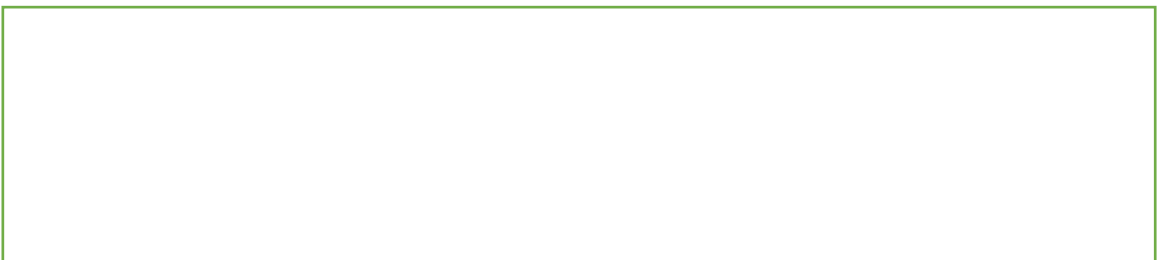
(d) $\int \frac{x^2 + 2x + 7}{x^3 + x^2 - 2} dx$



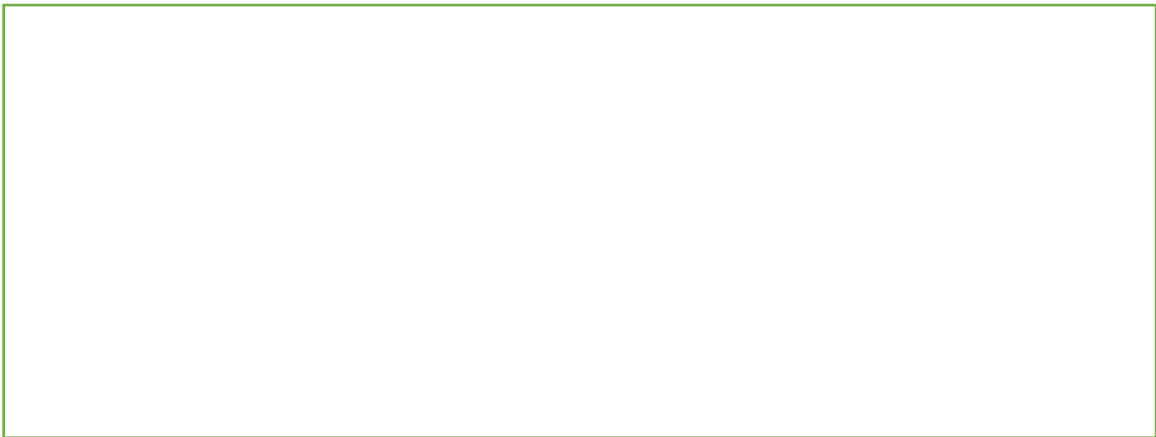
(e) $\int \frac{1}{x(x^2 + 1)^2} dx$



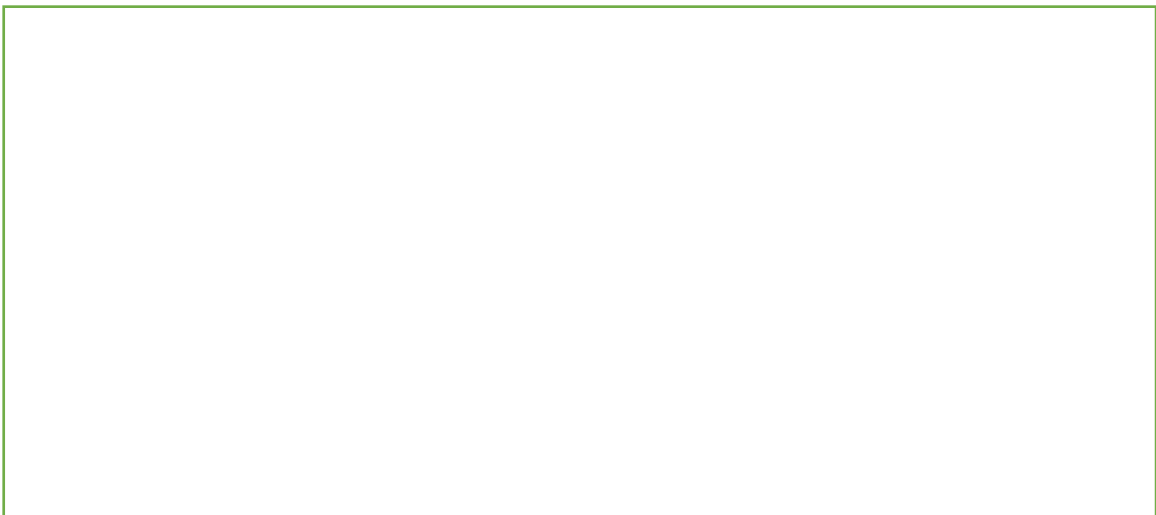
(f) $\int_{-1}^2 \frac{x^2}{\sqrt{2+x}} dx$



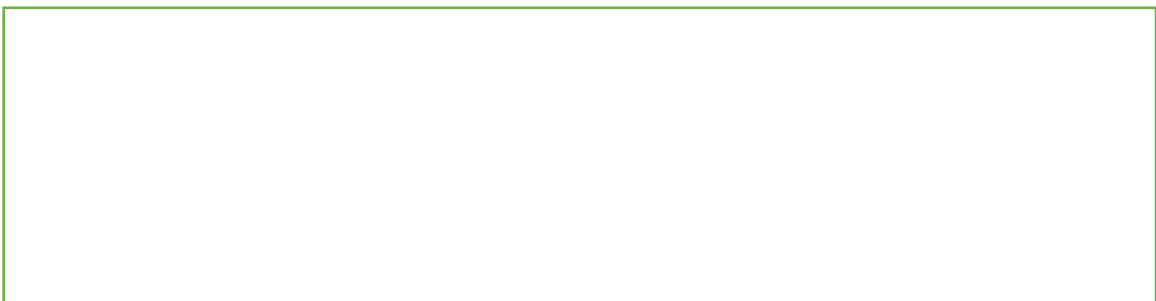
(g) $\int_1^3 4x\sqrt{6-2x} dx$



(h) $\int_{-6}^{-3} \frac{\sqrt{x^2-9}}{x} dx$



(i) $\int_0^1 \ln(x+1) dx$



Question 2

Suppose f is a continuous function. Find the value of the integral

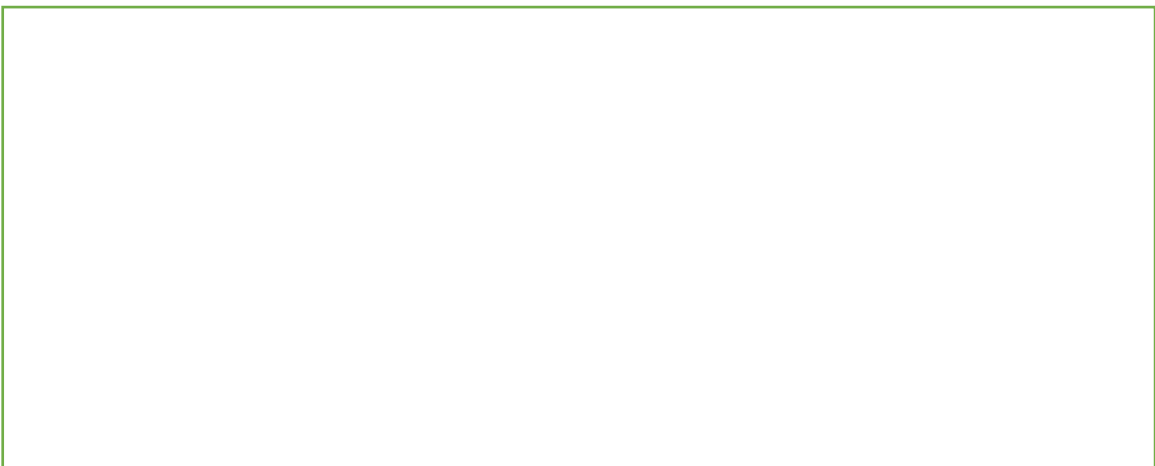
$$I = \int_0^a \frac{f(x)}{f(x) + f(a-x)} dx$$

by making the substitution $u = a - x$.

**Question 3**

Suppose f is continuous and $F'(x) = f(x)$.

If $\int_1^5 f(x) dx = 3$, $\int_2^6 f(x) dx = 4$, $\int_5^6 f(x) dx = 5$, and $F(1) = 6$, evaluate $F(2)$.



Question 4

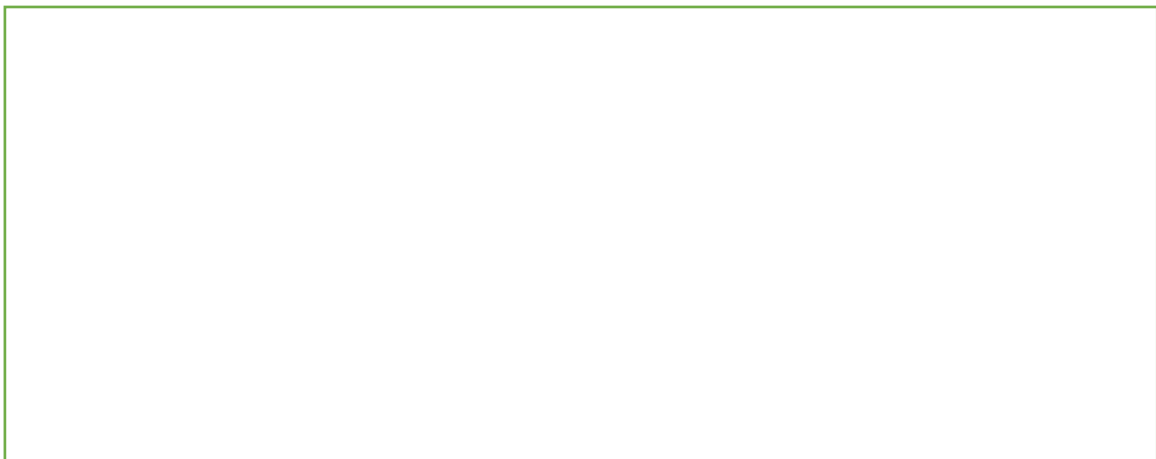
For a non-negative integer $n \geq 0$, $J_n = \int (\ln x)^n dx$. Express J_n in terms of J_{n-1}

for $n \geq 1$. Hence, find J_3 .

**Question 5**

Determine whether the following improper integral converges. If it does, determine the value of the integral.

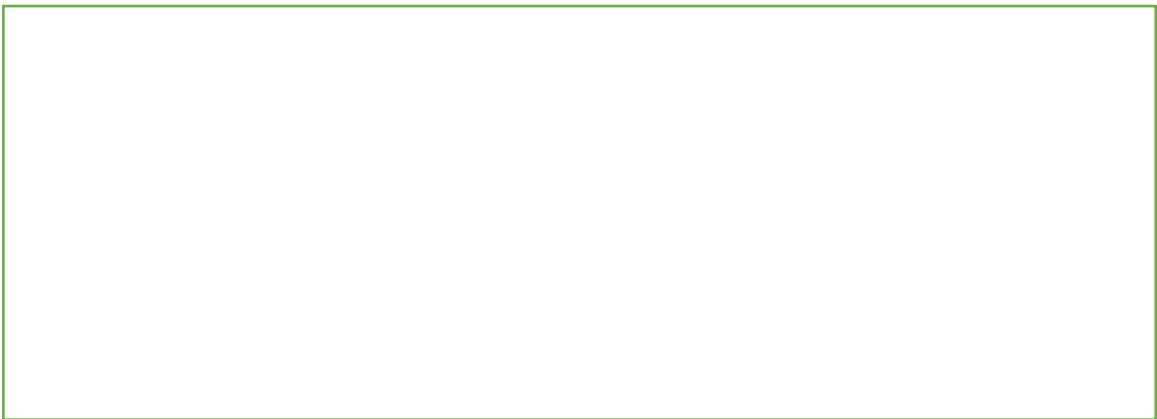
(a) $\int_4^5 \frac{1}{\sqrt{x-4}} dx$



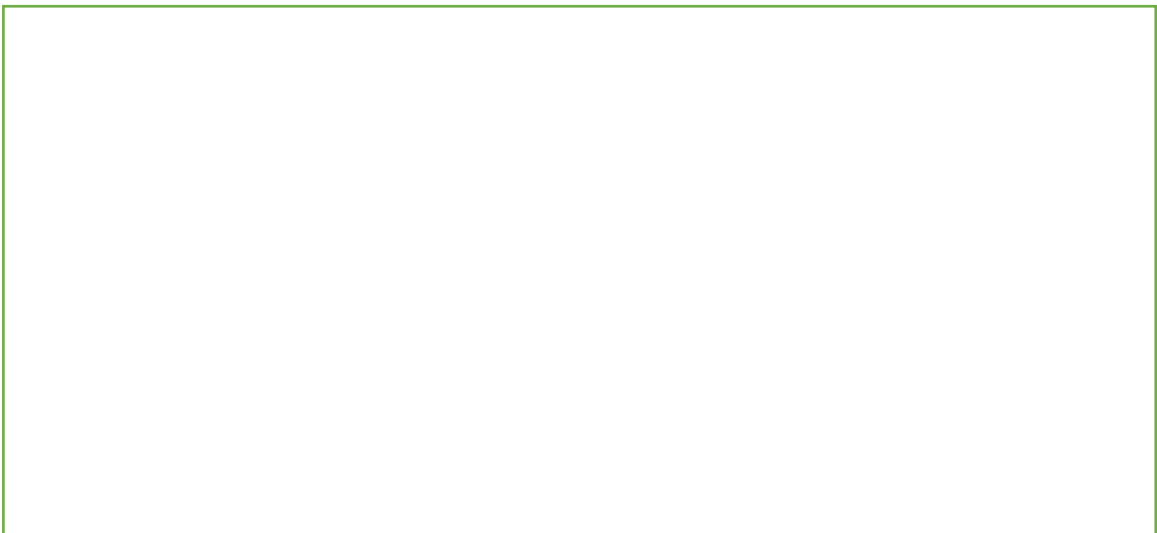
(b) $\int_4^{\infty} \frac{1}{\sqrt{x}} dx$



(c) $\int_{-1}^2 \frac{1}{x^2} dx$



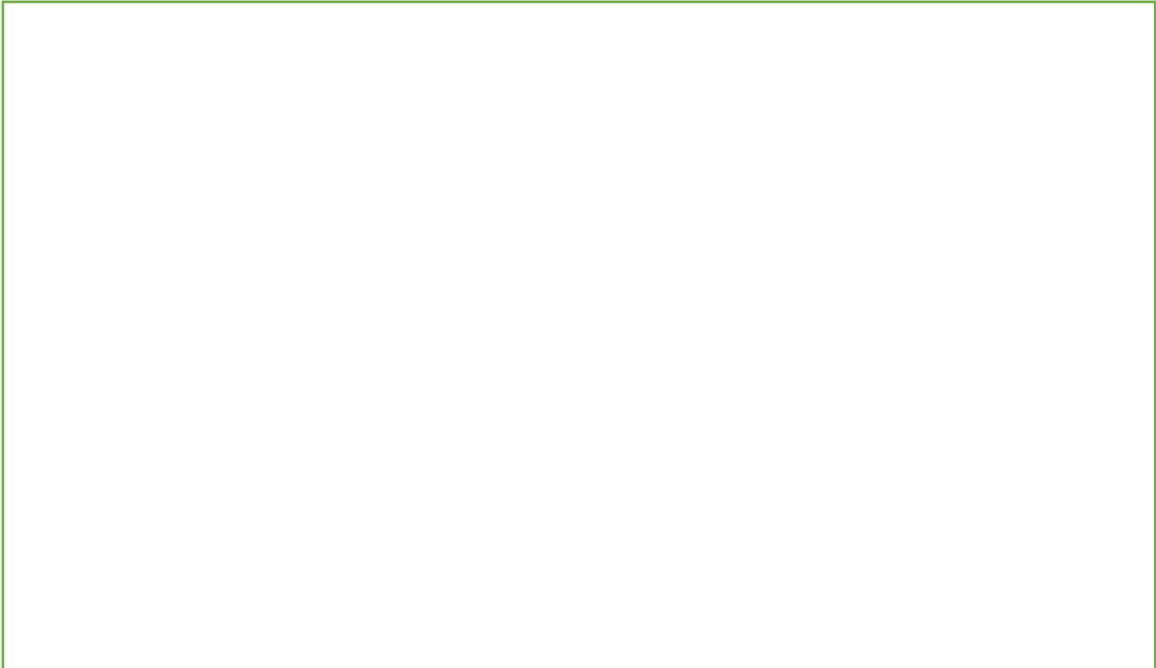
(d) $\int_{-\infty}^{\infty} \frac{1}{4x^2 + 9} dx$



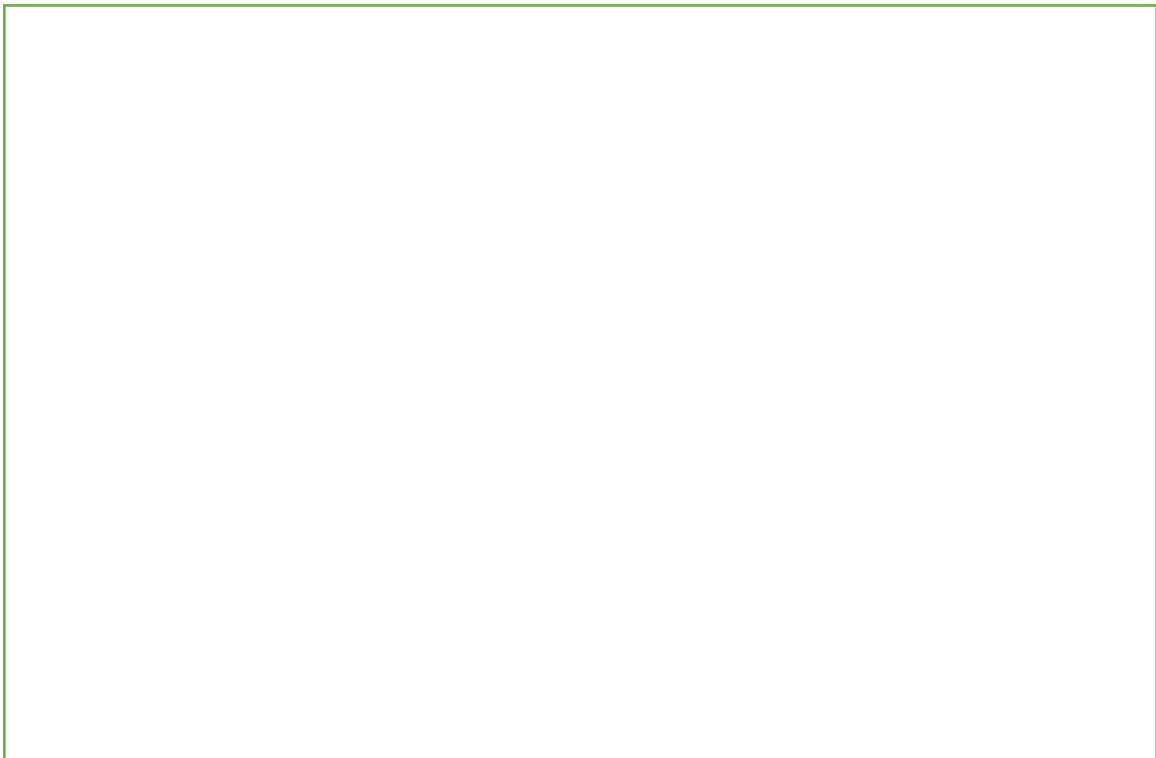
Question 6

Find the area A of the region enclosed by the functions:

(a) $x = y^3 - y^2$ and $x = 2y$



(b) $y = x$, $x = 2$, $y = 1/x$, and the x -axis



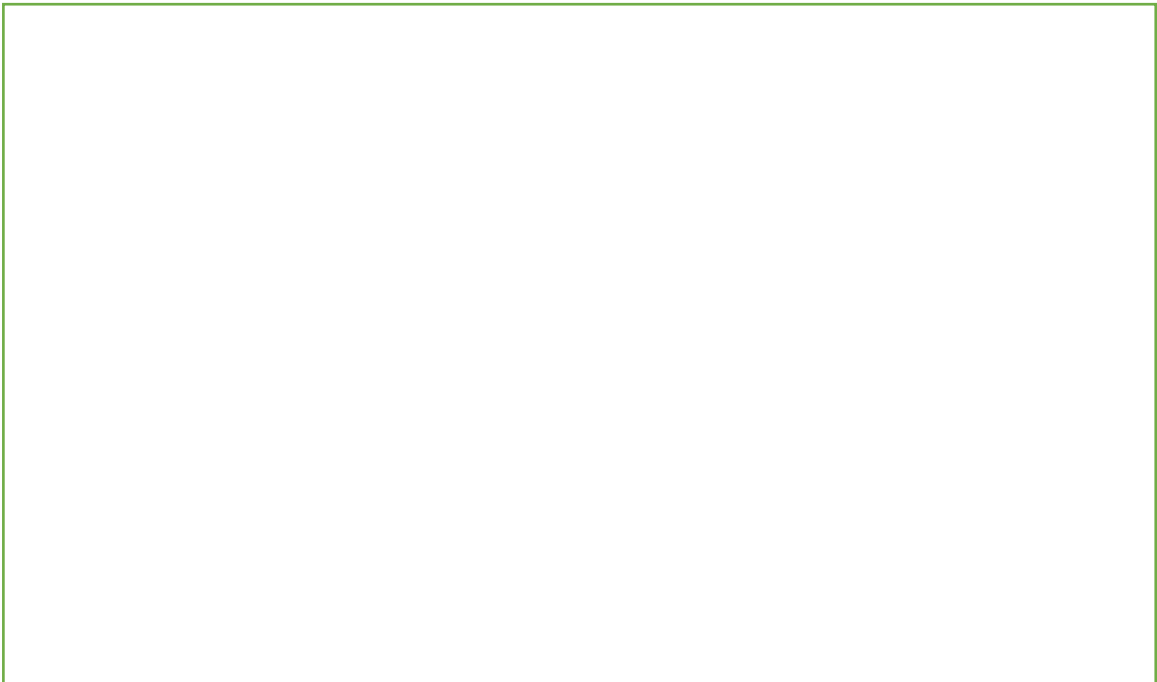
Question 7

Find the volume V of the solid generated by revolving about the x -axis the region between the graphs of the given equations.

(a) $y = \frac{1}{2}x^2 + 3, y = 12 - \frac{1}{2}x^2$



(b) $y = \sec x, y = \tan x, x = 0, x = 1$



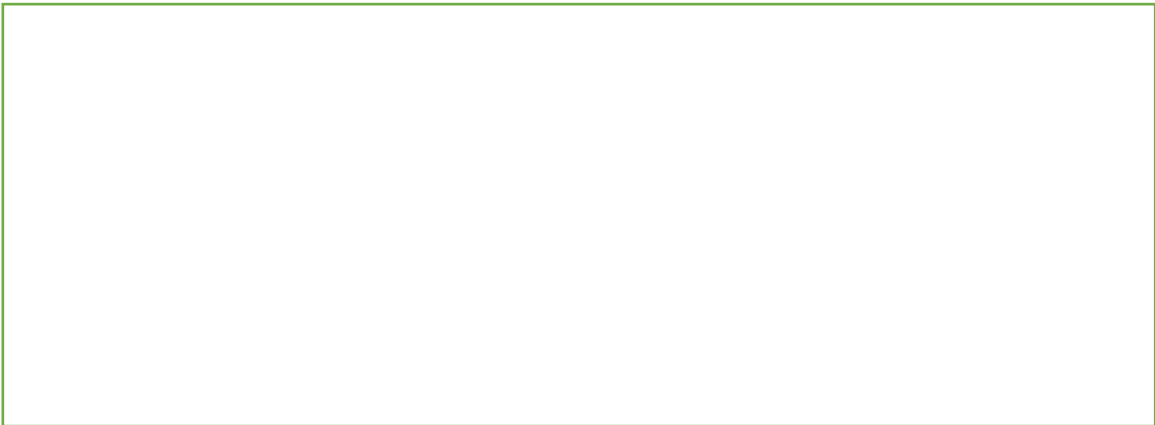
Question 8

Find the length L of the graph of

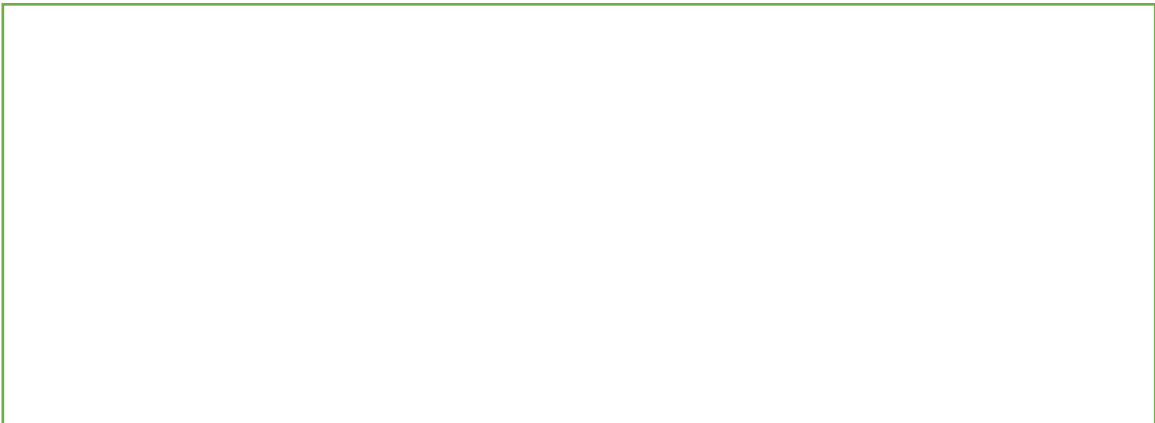
(a) $f(x) = x^{3/2} + 1$ for $0 \leq x \leq \frac{3}{4}$



(b) $f(x) = \ln x - \frac{1}{8}x^2$ for $1 \leq x \leq 2$

**Question 9**

Prove or disprove: If f is continuous, then $\int_0^1 f(x) dx = \int_0^1 f(1-x) dx$.



Question 10 2013/14 Semester 1 AMA1007 Examination Questions 5(b), (c) and 10.



Question 11 2013/14 Semester 2 AMA1007 Examination Questions 2 and 7.



Question 12 Consider $h(x) = 5x^2 - 3x + 4$. Use the open source online software CoCalc to compute the arc-length of $h(x)$ from $x = 0$ to $x = 3$, and plot $h(x)$ from $x = 0$ to $x = 3$. [Paste the CoCalc output inside the box.]

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