I.1 Antiderivatives and integration basics

a. Let $F(x)$ and $G(x)$ be differentiable functions on $[a, b]$. If $F'(x) = G'(x)$, then which of the following statements must be true? *Circle all true statements.*

i. $F(x) = G(x) + C$ for some constant C.

ii. $F(x) = G(x)$.

iii. $[F(x) - G(x)]' = 0$.

iv. $\displaystyle\int_a^b F'(x)\,dx = \int_a^b G'(x)\,dx$

v. $\displaystyle\int F'(x)\,dx = G(x) + C$

b. Complete the antidifferentiation formula below by writing an appropriate expression after the integral sign:

$$\int \qquad\qquad dx = \sin(3x) + C$$

c. If $F'(x) = 2x - \frac{3}{x^2}$ and $F(1) = 0$, what is $F(x)$? *Draw a box around your answer.*

II.1 Definite integrals and area

a. Evaluate the definite integral $\int_{-1}^{1} (x^5 + \sqrt{1-x^2})\, dx$.

Do not attempt to find an antiderivative of $\sqrt{1-x^2}$.

Draw a box around your final answer.

b. Let R be the region bounded by $y = 6x(1-x)$ (above), $y = 2x$ (below), $x = 0$ (left), and $x = 1/2$ (right). What is the area of the region R?

Draw a box around your final answer.

III.1 Integration by substitution

a. Which of the following integrals can be evaluated easily using u-substitution?

You do not have to evaluate the integral(s) you circle. You do not have to write down a choice of u that would work.

Circle all correct answers below.

i. $\int x^{-2}e^{1/x}\,dx$

ii. $\int e^{-x^2}\,dx$

iii. $\int xe^{-x^2}\,dx$

iv. $\int x^2e^{2x}\,dx$

v. $\int x^2e^{x^3}\,dx$

b. Evaluate $\int_0^{\sqrt{\pi}} \theta\sin(\theta^2)[1-\cos(\theta^2)]\,d\theta$. *Draw a box around your final answer.*

VI.1 Integration by Parts

This problem has 2 parts.

a. Evaluate $\int 9x^2 \ln x \, dx$ using integration by parts.

Clearly indicate your choices for u, v, du, dv, and draw a box around your final answer.

b. Evaluate $\int_1^2 9x^2 \ln x \, dx$.

You may use your answer from part (a.). If that answer is incorrect and you showed the work that got you to that answer, you will not be lose additional points for it in part (b.). Your answer for part (b.) must be in the form $a + b \ln 2$ where a and b are "nice" constants. *Draw a box around your answer.*
