

Name :

SS#

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*Instructions:* Do all of the following questions. Show your work and explain your answers.

**Do not use calculators.**

**Question 1:** (20 points) Find the following integrals

(a)  $\int (e^{\ln(x)})^{777} dx$ , where  $x > 0$ .

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

**Question 2:** (6 points) Find the value of  $(-1)^{\frac{99}{7777}}$ .

**Question 3:** (15 points) Let  $f$  and  $g$  be differentiable functions which satisfy  $g(x) = f(5x-2)$ , for all  $x$ . If  $f'(3) = \frac{7}{9}$ , what is  $g'(1)$ ? (*Here the prime (') stands for the derivative.*)

**Question 4:** (14 points) Let

$$F(x) = \begin{cases} 3x^2 - 1 & \text{if } x \geq 3 \\ \frac{4x^2}{5x^2+1} & \text{if } x < 3 \end{cases}$$

and let

$$G(x) = \begin{cases} 2x & \text{if } x \leq 0 \\ (x + 98)F(x) & \text{if } 0 < x < 2 \\ 5 & \text{if } x \geq 2 \end{cases}$$

Find  $G(1)$ .

**Question 5:** (15 points) Let  $f(x)$  be an **odd** real-valued function and  $g(x)$  be an **even** real-valued function. Assume that  $f$  and  $g$  are always defined and that  $g$  is never zero. Let

$$H(x) = \frac{f(x)}{g(x)} + (f(x))^3 + 5x.$$

Determine whether  $H(x)$  is even, odd, or neither.

(Recall that a function  $r(x)$  is even iff  $r(-x) = r(x)$ , for all  $x$ , and odd iff  $r(-x) = -r(x)$ , for all  $x$ .)

In the following questions assume that the given programs have no syntax / run-time errors.

**Question 6:** (15 points) What does the following program segment do? The input (*value of  $n$* ) must be greater or equal to 2.

```

:
int MyFunc(int n)
{
    // Your value of n must be greater than or equal to 2.
    int i, P = n;
    for (i = 2; i <= n - 1; i++)
        P = P * i;
    return P;
}

```

Also, determine **MyFunc(5)**.

**Question 7:** (15 points) The following program segment computes the value of the function  $f(x)$  for any given value of  $x$ . Determine the algebraic formula of  $f(x)$ . **Do NOT write  $f(x)$  as a piecewise function. It must have one piece only.**

```

:
double f(double x)
{
    double w
    if (x <= 0) (w = -5x);
    if (x > 0) (w = 5x);
    return w;
}

```