

What month is your birthday?

What are the first 2 digits of your address?

What are the last 2 digits of your zip code?

What are the last 2 digits of your social security number?

[IF YOU DO NOT HAVE A SOCIAL SECURITY NUMBER,
USE YOUR STUDENT ID NUMBER]

SCORE: ___ / 30 POINTS

NO CALCULATORS ALLOWED**YOU MUST SHOW PROPER CALCULUS LEVEL WORK
(INCLUDING SANITY CHECKS WHERE RELEVANT) TO EARN FULL CREDIT**Evaluate $\int_3^{\infty} x e^{-\frac{x}{3}} dx$.

SCORE: ___ / ___ POINTS

SEE 9:30 VERSION C QUESTION 4

Find $\int \frac{1}{1+e^x} dx$.

$\textcircled{or} \rightarrow \int \frac{1}{1+e^x} \cdot \frac{e^{-x}}{e^{-x}} dx = \int \frac{e^{-x}}{e^{-x}+1} dx = \int \frac{1}{u} du = -\ln|u| + C$
 $u = e^{-x} + 1$
 $du = -e^{-x} dx$
 $-du = e^{-x} dx$
 $= -\ln|e^{-x}+1| + C$
 $= -\ln(e^{-x}+1) + C$

SCORE: ___ / ___ POINTS

★ SEE 9:30 VERSION C QUESTION 3
FOR ALTERNATE SOLUTION

$u = e^x$
 $du = e^x dx$
 $\frac{1}{e^x} du = dx$

$$\frac{1}{1+e^x} \frac{1}{e^x} du = \frac{1}{u(u+1)} du$$

$$\begin{aligned}
 \int \frac{1}{u(u+1)} du &= \int \left(\frac{1}{u} - \frac{1}{u+1} \right) du \\
 &= \ln|u| - \ln|u+1| + C \\
 &= \ln|e^x| - \ln|e^x+1| + C \\
 &= x - \ln(e^x+1) + C
 \end{aligned}$$

PARTIAL FRACTIONS $\frac{1}{u(u+1)} = \frac{A}{u} + \frac{B}{u+1}$

$$1 = A(u+1) + Bu$$

$$u=0: 1 = A$$

$$u=-1: 1 = -B \Rightarrow B = -1$$

CHECK

$$u=1: \frac{1}{1(2)} = \frac{1}{2}$$

$$\frac{1}{1} + \frac{-1}{2} = \frac{1}{2} \checkmark$$

Evaluate $\int_0^5 (x-2)^{-4} dx$.

SCORE: ___ / ___ POINTS

$$= \int_0^2 (x-2)^{-4} dx + \int_2^5 (x-2)^{-4} dx$$

$$\hookrightarrow = \lim_{N \rightarrow 2^-} \int_0^N (x-2)^{-4} dx$$

$$= \lim_{N \rightarrow 2^-} -\frac{1}{3} (x-2)^{-3} \Big|_0^N$$

$$= \lim_{N \rightarrow 2^-} -\frac{1}{3} ((N-2)^{-3} + \frac{1}{8})$$

$$= \infty$$

DIVERGES

$$\int (x-2)^{-4} dx$$

$$u = x-2$$

$$du = dx$$

$$= \int u^{-4} du$$

$$= -\frac{1}{3} u^{-3}$$

$$= -\frac{1}{3} (x-2)^{-3}$$

Find $\int x^2 (x-1)^{-4} dx$.

SCORE: ___ / ___ POINTS

$$\begin{array}{rcl} \frac{u}{x^2} & \frac{dv}{(x-1)^{-4}} & \\ & + & \\ 2x & -\frac{1}{3} (x-1)^{-3} & \\ & - & \\ 2 & \frac{1}{6} (x-1)^{-2} & \\ & + & \\ 0 & -\frac{1}{6} (x-1)^{-1} & \end{array}$$

★ SEE 9:30 VERSION C
QUESTION 1 FOR
ALTERNATE SOLUTION

$$-\frac{1}{3} x^2 (x-1)^{-3} - \frac{1}{3} x (x-1)^{-2} - \frac{1}{3} (x-1)^{-1} + C$$

SCORE: ____ / 30 POINTS

NO CALCULATORS ALLOWED**YOU MUST SHOW PROPER CALCULUS LEVEL WORK
(INCLUDING SANITY CHECKS WHERE RELEVANT) TO EARN FULL CREDIT**Evaluate $\int \frac{1}{\sqrt{4-e^{6x}}} dx$ using the table of integrals.

SCORE: ____ / ____ POINTS

STATE THE NUMBER OF THE RULE YOU ARE USING.

$$\begin{aligned}
 u &= e^{3x} \\
 du &= 3e^{3x} dx \\
 \frac{1}{3e^{3x}} du &= dx \\
 \frac{1}{\sqrt{4-e^{6x}}} \cdot \frac{1}{3e^{3x}} du &= \frac{1}{3} \frac{1}{e^{3x} \sqrt{4-e^{6x}}} du = \frac{1}{3} \frac{1}{u \sqrt{4-u^2}} du \\
 \frac{1}{3} \int \frac{1}{u \sqrt{4-u^2}} du &= -\frac{1}{3} \frac{1}{2} \ln \left| \frac{2+\sqrt{4-u^2}}{u} \right| + C \\
 \text{RULE (35) } a=2 &= -\frac{1}{6} \ln \left| \frac{2+\sqrt{4-e^{6x}}}{e^{3x}} \right| + C \\
 &= -\frac{1}{6} \ln (2+\sqrt{4-e^{6x}}) + \frac{1}{2}x + C
 \end{aligned}$$

USE THE SPACE BELOW AND ON THE OTHER SIDE FOR SCRATCH WORK