

SCORE: ___ / 30 POINTS

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]**NO CALCULATORS ALLOWED****YOU MUST SHOW PROPER CALCULUS LEVEL WORK
(INCLUDING SANITY CHECKS WHERE RELEVANT) TO EARN FULL CREDIT**

Find $\int \frac{1}{x^2 \sqrt{x^2 - 9}} dx$.

SCORE: ___ / 7 POINTS

SEE 7:30 VERSION A

FOR EACH QUESTION:
SUBTRACT $\frac{1}{2}$ IF MISSING
"+ C"SUBTRACT $\frac{1}{2}$ FOR EACH
MISSING ABSOLUTE
VALUE

Find $\int \frac{x+7}{(x-1)(x+1)^2} dx$.

SCORE: ___ / 7 POINTS

$$= \int \left(\frac{A}{x-1} + \frac{B}{x+1} + \frac{C}{(x+1)^2} \right) dx$$

$$= \int \left(\frac{2}{x-1} + \frac{2}{x+1} + \frac{3}{(x+1)^2} \right) dx$$

$$= \frac{2 \ln|x-1|}{\frac{1}{2}} - \frac{2 \ln|x+1|}{\frac{1}{2}} + \frac{3}{x+1} + C$$

$$x+7 = A(x+1)^2 + B(x-1)(x+1) + C(x-1)$$

$$x=1: 8 = 4A \rightarrow A=2$$

$$x=-1: 6 = -2C \rightarrow C=-3$$

$$x=0: 7 = A - B - C$$

$$7 = 2 - B + 3$$

$$B = -2$$

SANITY CHECK:

$$x=2: \text{ORIGINAL} = \frac{9}{9} = 1$$

DECOMPOSITION =

$$\frac{2}{1} + \frac{-2}{3} - \frac{3}{9} = 1$$

Find $\int x^2 (\ln x)^2 dx$.

SCORE: ___ / 6 POINTS

$$\begin{array}{r} \frac{u}{(ln x)^2} \quad \frac{dv}{+x^2} \\ 2 \ln x \cdot \frac{1}{x} \quad \frac{1}{3} x^3 \\ \hline 2 \ln x \quad \frac{1}{3} x^2 \\ \frac{2}{x} \quad \frac{1}{9} x^3 \\ \hline 2 \quad \frac{1}{9} x^2 \\ 0 \quad \frac{1}{27} x^3 \end{array}$$

$$\underbrace{\frac{1}{3} x^3 (\ln x)^2}_{(3)} - \underbrace{\frac{2}{9} x^3 \ln x}_{(2)} + \underbrace{\frac{2}{27} x^3}_{(1)} + C$$

Find $\int e^{3x} \cos 4x dx$.

SCORE: ___ / 6 POINTS

$$\begin{array}{r} \frac{u}{\cos 4x} \quad \frac{dv}{+e^{3x}} \\ -4 \sin 4x \quad \frac{1}{3} e^{3x} \\ -16 \cos 4x \quad \frac{1}{9} e^{3x} \end{array}$$

$$= \underbrace{\frac{1}{3} e^{3x} \cos 4x}_{(1\frac{1}{2})} + \underbrace{\frac{4}{9} e^{3x} \sin 4x}_{(1\frac{1}{2})} - \underbrace{\frac{16}{9} \int e^{3x} \cos 4x dx}_{(1)}$$

so,

$$\underbrace{\frac{25}{9} \int e^{3x} \cos 4x dx}_{(1)} = \frac{1}{3} e^{3x} \cos 4x + \frac{4}{9} e^{3x} \sin 4x$$

SEE ALSO

7:30 VERSION A $\int e^{3x} \cos 4x dx = \underbrace{\frac{3}{25} e^{3x} \cos 4x}_{(1\frac{1}{2})} + \underbrace{\frac{4}{25} e^{3x} \sin 4x}_{(1\frac{1}{2})} + C$

Find $\int \frac{17-x^2}{x^2+2x-15} dx$.

SCORE: ___ / 4 POINTS

$$\begin{aligned} &= \int \left(\underbrace{-1}_{(1)} + \underbrace{\frac{2x+2}{x^2+2x-15}}_{(1)} \right) dx \\ &= \underbrace{-x}_{(1\frac{1}{2})} + \underbrace{\ln |x^2+2x-15|}_{(1\frac{1}{2})} + C \end{aligned}$$

$$\begin{array}{r} x^2+2x-15 \overline{) -x^2 \quad +17} \\ \underline{-x^2-2x+15} \quad \\ 2x+2 \end{array}$$