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اللجنة الأكاديمية لقسم الهندسة المدنية

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سنوات محلولة (الفيرست)

تفاضل وتكامل 2

إعداد الفريق الأكاديمي



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لجنة المدني | Civilitree HU

بسم الله الرحمن الرحيم

يقدم لكم الفريق الأكاديمي في لجنة سيفيلتي سنوات محلولة لمادة -تفاضل
وتكامل 2-

ونذكر بأن هذا اجتهاد من زملائنا فمن وجد خطأً فليصلحه وليتقدم بواجب
النصح لأخيه
ودمتم بخير جميعاً

#سيفيلتي
#لجنة_المدني

10. By using the trigonometric substitution

*

(2 Points)

$x = 3 \sec(\theta)$, where $0 \leq \theta < \frac{\pi}{2}$,

the integral $\int \frac{27}{x^3 \sqrt{x^2 - 9}} dx$ can be transformed into one of the following integrals

☐ $\int \csc^2(\theta) \cdot d\theta$

☐ $\int \sin^2(\theta) \cdot d\theta$

☐ $\int \cot^2(\theta) \cdot d\theta$

☒ $\int \cos^2(\theta) \cdot d\theta$

☐ $\int \cos(\theta) \cdot d\theta$

$$\int \frac{27}{x^3 \sqrt{x^2 - 9}} dx$$

$$x = 3 \sec \theta$$

$$dx = 3 \sec \theta \tan \theta d\theta$$

$$\int \frac{\cancel{27} \cdot \cancel{3 \sec \theta} \tan \theta}{\cancel{27} \cdot \sec^3 \theta \sqrt{9 \sec^2 \theta - 9}} d\theta$$

$$\int \frac{3 \tan \theta}{\sec^2 \theta \sqrt{\tan^2 \theta \cdot 9}}$$

$$= \int \frac{\cancel{3 \tan \theta}}{\cancel{2} \sec^2 \theta \cancel{\tan \theta}}$$

$$= \int \cos^2 \theta d\theta$$

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17. What is the value of A in the partial fraction decomposition *
(3 Points)

$$\int \frac{4x}{(x-1)^2(x+1)} dx =$$

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

☐ -4

☒ 1

☐ -3

☐ 2

☐ 4

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$$\int \frac{4x}{(x-1)^2 (x+1)}$$

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

$$A(x-1)(x+1) + B(x+1) + C(x-1)^2 = 4x$$

$$\text{when } x=1 \rightarrow 2B=4 \quad \boxed{B=2}$$

$$\text{when } x=-1 \rightarrow 4C=-4 \quad \boxed{C=-1}$$

$$\text{when } x=0 \rightarrow -A+2-1=0 \quad \boxed{A=1}$$

1. Suppose that *
(2 Points)

$f(0) = f(2)$, $f'(2) = 2$, and f' is continuous.

Find $\int_0^2 x f''(x) \cdot dx$

☐ 2

☐ 1

☐ 3

☐ 5

☒ 4



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$$\int_0^2 x \cdot f''(x) dx$$

$$u = x \quad du = dx$$

$$dv = f''(x) dx \quad v = f'(x)$$

$$x \cdot f'(x) - \int f'(x) dx$$

$$x f'(x) - f(x) \Big|_0^2$$

$$2 \cdot 2 - f(2) - (0 - f(0))$$

$$4 - \cancel{f(2)} + \cancel{f(0)}$$

$$\text{and } f(2) = f(0)$$

$$= 4$$

4. Integrating * (2 Points)

$\int x \sin^{-1}(x) \cdot dx$ by parts
in correct way we obtain
an expression of the form $A - \int B \cdot dx$
then $B =$

☐ $-\frac{x^2}{2\sqrt{1-x^2}}$

☐ $\frac{x}{1+x^2}$

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☐ $\frac{x^2}{2(1+x^2)}$

☒ $\frac{x^2}{2\sqrt{1-x^2}}$



☐ $\frac{x}{2\sqrt{1-x^2}}$

$$\int x \sin^{-1}(x) dx$$

$$u = \sin^{-1}(x)$$

$$du = \frac{1}{\sqrt{1-x^2}} dx$$

$$dv = x dx$$

$$v = \frac{x^2}{2}$$

$$\frac{x \sin^{-1}(x)}{2} - \int \frac{x^2}{2\sqrt{1-x^2}} dx$$

16. To integrate the function *
(2 Points)

$\frac{x^3}{(x-2)(x+2)}$ by partial fractions

one should try to express it in the form

☐ $1 + \frac{A}{x-2} + \frac{B}{x+2}$

☐ $\frac{A}{x-2} + \frac{B}{x+2}$

☐ $\frac{Ax+B}{x-2} + \frac{Cx+D}{x+2}$

☒ $x + \frac{A}{x-2} + \frac{B}{x+2}$ ✓

☐ $\frac{Ax}{x-2} + \frac{Bx}{x+2}$

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

$$\begin{array}{r} x \\ x^2-4 \overline{) x^3} \\ \underline{x^3-4x} \\ 4x \end{array}$$

$$x + \frac{4x}{(x-2)(x+2)}$$

$$x + \frac{A}{x-2} + \frac{B}{x+2}$$

9. Which substitution is needed to evaluate the integral *
(2 Points)

$$\int \sec^5(\theta) \tan^7(\theta) \cdot d(\theta)$$

☐ $u = \sin(\theta)$

☐ $u = \cos(\theta)$

☐ $u = \cot(\theta)$

☐ $u = \tan(\theta)$

☒ $u = \sec(\theta)$

19. Question *
(2 Points)

$$\int \frac{x+2}{x-1} dx =$$

☒ $x + 3 \ln|x - 1| + C$

☐ $x + 5 \ln|x - 1| + C$

☐ $x + 4 \ln|x - 1| + C$

☐ $x + 2 \ln|x - 1| + C$

☐ $x + \ln|x - 1| + C$

20. Find the Cartesian equation for the

$$\int \frac{x+2}{x-1} dx$$

$$\begin{array}{r} \\ x-1 \overline{) x+2} \\ \underline{x-1} \\ 3 \end{array}$$

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

$$x + 3 \ln|x-1| + c$$

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13. what is the suitable substitution required to evaluate the integral *
(2 Points)

$$\int \frac{x}{\sqrt{2x-3+x^2}} dx$$

☐ $x = 2 \tan(\theta) + 1$

☐ $x = 2 \sec(\theta) + 1$

☐ $x = 2 \sec(\theta) - 1$

☐ $x = 2 \sin(\theta) + 1$

☐ $x = 2 \tan(\theta) - 1$

14. The two polar points *
(2 Points)

$$\int \frac{x}{\sqrt{2x-3+x^2}}$$

by Completing square

$$\int \frac{x}{\sqrt{(x+1)^2 - 4}}$$

$$x+1 = 2 \sec \theta$$

$$x = 2 \sec \theta - 1$$

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17. *

(2 Points)

$$\int \cos(5x)\cos(x). dx =$$

☒ $\frac{1}{2} \left(\frac{\sin(4x)}{4} + \frac{\sin(6x)}{6} \right) + C$

☐ $\frac{1}{2} \left(\frac{\cos(4x)}{4} - \frac{\cos(6x)}{6} \right) + C$

☐ $-\frac{1}{2} \left(\frac{\sin(4x)}{4} - \frac{\sin(6x)}{6} \right) + C$

☐ $\frac{1}{2} \left(\frac{\sin(4x)}{4} - \frac{\sin(6x)}{6} \right) + C$

☐ $-\frac{1}{2} \left(\frac{\sin(4x)}{4} + \frac{\sin(6x)}{6} \right) + C$

18. Which one of the following polar

$$\int \cos(5x) \cdot \cos(x) dx$$

$$\int \left(\frac{1}{2} [\cos(4x) + \cos(6x)] \right) dx$$

$$\frac{1}{2} \left[\int \cos 4x dx + \int \cos 6x dx \right]$$

$$\frac{1}{2} \left(\frac{\sin 4x}{4} + \frac{\sin 6x}{6} \right) + C$$

16. By using the trigonometric substitution *
(3 Points)

$$x = \frac{3}{2} \tan(\theta), \text{ where } -\frac{\pi}{2} < \theta < \frac{\pi}{2},$$

$$\text{the integral } \int \frac{16x^3}{3(4x^2+9)^{\frac{3}{2}}} dx$$

can be transformed into
one of the following integrals

☐ $\int \frac{\tan^2(\theta)}{\sec^2(\theta)} d\theta$

☐ $\int \frac{\tan^3(\theta)}{\sec^3(\theta)} d\theta$

☐ $\int \frac{\tan^2(\theta)}{\sec^3(\theta)} d\theta$

☐ $\int \frac{\tan^3(\theta)}{\sec(\theta)} d\theta$

☐ $\int \frac{\tan^3(\theta)}{\sec^2(\theta)} d\theta$

Which one of the following integrals .3

* represent the area

(3 نقطة)

inside $r = 1 - \sin(\theta)$

and outside $r = 1$.

$$\frac{16}{3} \int \frac{x^3}{\sqrt{(2x^2+3)^3}} dx \quad x = \frac{3}{2} \tan \theta$$

$$dx = \frac{3}{2} \sec^2 \theta d\theta$$

$$\frac{16}{3} \int \frac{27/8 \tan^3 \theta}{(\sqrt{9(\sec^2 \theta)})^3} \times \frac{3}{2} \sec^2 \theta d\theta$$

$$\frac{16}{3} \int \frac{\tan^3 \theta}{\sec^3 \theta} \times \frac{3}{2} \sec^2 \theta d\theta$$

$$\int \frac{\tan^3 \theta}{\sec \theta} d\theta$$

A suitable substitution u will give the .7

* following

(3 نقطة)

$$\int \tan^3(x) \sec^n(x) dx = \int u^6 - u^4 \cdot du$$

Then $n =$

5 ☐

6 ☐

7 ☐

3 ☐

4 ☐

Find the value of the constant C for .5
which the following integral is convergent

*

(3 نقطة)

$$\int_0^{\infty} \left(\frac{x}{x^2+1} - \frac{C}{3x+1} \right) dx$$

2 ☐

4 ☐

3 ☐

6 ☐

5 ☐

$$\int \tan^3 x \sec x \, dx = \int u^6 - u^4 \, du$$

بالتعويض

$$n=5$$

$$\int \tan^3 x \sec x \, dx \quad u = \sec x \quad du = \sec x \, dx$$

$$\int (\sec^2 x - 1) u^4 \, du \rightarrow \int u^6 - u^4 \, du$$

الخطوة الأخيرة

2. Which one of the following improper integrals is divergent *
(2 Points)

☐ $\int_1^{\infty} x^{\pi-7} dx$

☐ $\int_1^{\infty} \frac{1}{x^{\sqrt{2}}} dx$

☐ $\int_1^{\infty} \frac{1}{x^e} dx$

☐ $\int_1^{\infty} \frac{1}{x^{1.1}} dx$

☐ $\int_1^{\infty} x^{3-e} dx$

$$(a) \int_1^{\infty} x^{11-7} dx$$

$$\frac{1}{x^p} \quad \begin{matrix} p > 1 \text{ con} \\ p \leq 1 \text{ div} \end{matrix}$$

$$\rightarrow \int_1^{\infty} \frac{1}{x^{7-11}} dx \quad \times \text{ con}$$

(b) con, (d) con, (c) con

$$(e) \int_1^{\infty} x^{3-e} dx$$

$$\rightarrow \int_1^{\infty} \frac{1}{x^{e-3}} dx \quad \checkmark \text{ divergant}$$

14. If m, n are positive integers, where *
(1 Point)

$m = n$, then $\int_{-\pi}^{\pi} \sin(mx) \sin(nx) \cdot dx = \pi$

☐ False

☐ True

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