Mathematics Review Course
Summer 2023
Problem Set 04
Solutions

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Integration

1. [Paul Dawkins] $\int z^7 - 48x^{11} - 5x^{16} dz$

Solution:
$$\frac{1}{8}z^8 - 4z^{12} - \frac{5}{17}z^{17} + C$$

2. [Paul Dawkins] $\int \sqrt{x^7} - 7x^{5/6} + 17x^{10/3} dx$

Solution:
$$\frac{2}{9}x^{9/2} - \frac{42}{11}x^{11/6} + \frac{51}{13}x^{13/3} + C$$

3. [Paul Dawkins] $\int \frac{4}{x^2} + 2 - \frac{1}{8x^3} dx$

Solution:
$$-4x^{-1} + 2x + \frac{1}{16}x^{-2} + C$$

4. [Paul Dawkins] $\int (t^2 - 1)(4 + 3t) dt$

Solution:
$$\frac{3}{4}t^4 + \frac{4}{3}t^3 - \frac{3}{2}t^2 - 4t + C$$

5. [Paul Dawkins] $\int t^3 - \frac{e^{-t} - 4}{e^{-t}} dt$

Solution:
$$\frac{1}{4}t^4 - t + 4e^t + C$$

Integration by Substitution

6. [Paul Dawkins] $\int (3 - 4w)(4w^2 - 6w + 7)^{10} dw$

Solution:

$$\begin{aligned} u =& 4w^2 - 6w + 7 \\ du =& 10w - 6dw \\ \int(\cdot) =& \frac{-1}{22}(4w^2 - 6w + 7)^{11} + C \end{aligned}$$

7. [Paul Dawkins] $\int 5(z-4)(z^2-8z)^{1/3}dz$

Solution:

$$\begin{aligned} u =& z^2 - 8z \\ du =& 2z - 8dz \\ \int(\cdot) =& \frac{15}{8}(z^2 - 8z)^{4/3} + C \end{aligned}$$

8. [Paul Dawkins] $\int \frac{4w+3}{4w^2+6w-1}dw$

Solution:

$$\begin{aligned} u =& 4w^2 + 6w - 1 \\ du =& 8w + 6dw \\ \int(\cdot) =& \frac{1}{2}ln(4w^2 + 6w - 1) + C \end{aligned}$$

9. [Paul Dawkins] $\int(7y-2y^3)e^{y^4-7y^2}dy$

Solution:

$$\begin{aligned} u =& y^4 - 7y^2 \\ du =& 4y^3 - 14ydy \\ \int(\cdot) =& \frac{-1}{2}e^{y^4-7y^2} + C \end{aligned}$$

10. [Paul Dawkins] $\int \frac{3x}{(1+9x^2)^4}dx$

Solution:

$$\begin{aligned} u =& 1 + 9x^2 \\ du =& 18xdx \\ \int(\cdot) =& \frac{-1}{18}\frac{1}{(1+9x^2)^3} + C \end{aligned}$$

Integration by Parts

11. $\int \frac{ln(x)}{x^2}dx$

Solution:

$$
\begin{aligned}
u =& ln(x) \\
du =& \frac{1}{x}dx \\
dv =& -\frac{-1}{x} \\
v =& \frac{1}{x^2} \\
\int(\cdot) =& \frac{-ln(x)-1}{x} + C
\end{aligned}
$$

12. [UC Davis] $\int \frac{ln(x)}{x^5}dx$

Solution:

$$
\begin{aligned}
u =& ln(x) \\
du =& \frac{1}{x}dx \\
dv =& \frac{1}{x^5}dx \\
v =& \frac{-1}{4x^4} \\
\int(\cdot) =& \frac{-ln(x)}{4x^4} - \frac{1}{16x^4} + C
\end{aligned}
$$