

## Calculus Worksheet #4 Unit 9 Selected Solutions

Integrate each of the following.

$$\begin{aligned}
 1. \quad \int x(x-5)^4 dx &= \int (u+5)u^4 du = \\
 \text{let } u &= x-5 &= \int (u^5 + 5u^4) du = \\
 x &= u+5 &= \frac{1}{6}u^6 + u^5 + C = \\
 dx &= du &= \frac{1}{6}u^5(u+6) + C \\
 & &= \frac{1}{6}(x-5)^5[(x-5)+6] + C \\
 & &= \frac{1}{6}(x-5)^5(x+1) + C
 \end{aligned}$$

$$\begin{aligned}
 3. \quad \int x(5x-2)^5 dx &= \frac{1}{5} \int (u+2)u^5 \left[\frac{1}{5} du\right] = \\
 &= \frac{1}{25} \int (u^6 + 2u^5) du = \\
 \text{let } u &= 5x-2 &= \frac{1}{25} \left[ \frac{1}{7}u^7 + \frac{1}{3}u^6 \right] + C \\
 x &= \frac{1}{5}(u+2) &= \frac{1}{525} u^6(3u+7) + C \\
 dx &= \frac{1}{5} du &= \frac{1}{525} (5x-2)^6 [3(5x-2)+7] + C \\
 & &= \frac{1}{525} (5x-2)^6 (15x+1) + C
 \end{aligned}$$

Alternate method

$$\begin{aligned}
 7. \quad \int x\sqrt{2x+3} dx &= \frac{1}{2} \int (u-3)\sqrt{u} \left[\frac{1}{2} du\right] = \\
 \text{let } u &= 2x+3 &= \frac{1}{4} \int \left[ u^{\frac{3}{2}} - 3u^{\frac{1}{2}} \right] du = \\
 x &= \frac{1}{2}(u-3) &= \frac{1}{4} \left[ \frac{2}{5}u^{\frac{5}{2}} - 2u^{\frac{3}{2}} \right] + C \\
 dx &= \frac{1}{2} du &= \frac{1}{10}u^{\frac{3}{2}}(u-5) + C \\
 & &= \frac{1}{10}(2x+3)^{\frac{3}{2}}[(2x+3)-5] + C \\
 & &= \frac{1}{5}(2x+3)^{\frac{3}{2}}(x-1) + C
 \end{aligned}$$

$$\begin{aligned}
 7. \quad \int x\sqrt{2x+3} dx &= \frac{1}{2} \int (v^2-3)(v)(v dv) = \\
 \text{let } v &= \sqrt{2x+3} &= \frac{1}{2} \int (v^4 - 3v^2) dv \\
 v^2 &= 2x+3 &= \frac{1}{2} \left[ \frac{1}{5}v^5 - v^3 \right] + C \\
 x &= \frac{1}{2}(v^2-3) &= \frac{1}{10}v^3(v^2-5) + C \\
 dx &= v dv &= \frac{1}{10}(2x+3)^{\frac{3}{2}}[(2x+3)-5] + C \\
 & &= \frac{1}{5}(2x+3)^{\frac{3}{2}}(x-1) + C
 \end{aligned}$$