Warmup 5.5

Evaluate the following indefinite integrals:

1. $\int 2x^2 + 3x - 5\, dx$

$$\boxed{\frac{2}{3}x^3 + \frac{3}{2}x^2 - 5x + C}$$

2. $\int \sqrt{1-3x}\, dx$

$u = 1-3x$

$\frac{du}{dx} = -3$

$dx = -\frac{1}{3}du$

$= \int u^{\frac{1}{2}} \cdot -\frac{1}{3}\, du$

$= \frac{2}{3}u^{\frac{3}{2}} \cdot -\frac{1}{3} + c$

$\boxed{= \frac{-2}{9}(1-3x)^{3/2} + C}$

3. $\int (1+2x)^6 dx$

$u = 1+2x$

$\frac{du}{dx} = 2$

$dx = \frac{1}{2}du$

$= \int (u)^6 \cdot \frac{1}{2}\, du$

$= \frac{1}{7}(u^7) \cdot \frac{1}{2} + c$

$\boxed{= \frac{1}{14}(1+2x)^7 + C}$

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

$u = x^2 - x$

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

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

$= \int \frac{\cancel{2x-1}}{\sqrt{u}} \cdot \frac{1}{\cancel{2x-1}}\, du$

$= \int u^{-\frac{1}{2}}\, du$

$= \frac{2}{1}u^{\frac{1}{2}} + C$

$\boxed{= 2\sqrt{x^2-x} + C}$

5. $\int \frac{5}{2+x} dx$

$u = 2+x$

$\frac{du}{dx} = 1$

$du = dx$

$\int \frac{5}{u} \cdot du$

$5 \ln u + c$

$\boxed{5\ln(2+x) + c}$

6. $* \int \frac{dx}{1+9x^2}$

$u = 3x$

$\frac{du}{dx} = 3$

$dx = \frac{1}{3}du$

$\int \frac{1}{1+u^2} \cdot \frac{1}{3}\, du$

$\frac{1}{3}\tan^{-1}(u) + c$

$\frac{1}{3}\tan^{-1}(3x) + c$

7. $\int \sin^2 x\, dx$

trig identity $1 - 2\sin^2 x = \cos 2x$

$1 - \cos 2x = 2\sin^2 x$

$\sin^2 x = \frac{1}{2} - \frac{1}{2}\cos 2x$

$\int \frac{1}{2} - \frac{1}{2}\cos 2x\, dx$

$\frac{1}{2}x - \frac{1}{2}\sin(2x) \cdot \frac{1}{2} + C$

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

8. $\int 5x e^{3x^2} dx$

$u = 3x^2$

$\frac{du}{dx} = 6x$

$dx = \frac{1}{6x} du$

$\int 5\cancel{x} \cdot e^u \cdot \frac{1}{6\cancel{x}} du$

$\frac{5}{6}e^u + C$

$\boxed{\frac{5}{6}e^{3x^2} + C}$

9. $\int e^{3\ln x} dx$

use exponent law $(x^a)^b = x^{a \cdot b}$

$\int (e^{\ln x})^3\, dx$

$\int x^3\, dx$

$\boxed{\frac{1}{4}x^4 + C}$

10. $\int \frac{(2+\ln x)^3}{x} dx$

$u = 2 + \ln x$

$\frac{du}{dx} = \frac{1}{x}$

$dx = x \cdot du$

$\int \frac{u^3}{\cancel{x}} \cdot \cancel{x}\, du$

$\frac{1}{4}u^4 + C$

$\boxed{\frac{1}{4}(2+\ln x)^4 + C}$