

$$\textcircled{1} \int (x+3)(x-1)^5 dx$$

U-SUB
DAY 2 - EXTRA X

$$u = x-1$$

$$du = dx$$

$$x = u+1$$

$$\int (u+1+3)u^5 du$$

$$\int u^6 + 4u^5 du = \frac{u^7}{7} + \frac{4u^6}{6} + C$$

$$\boxed{= \frac{(x-1)^7}{7} + \frac{2}{3}(x-1)^6 + C}$$

$$\textcircled{2} \int x\sqrt{4-x} dx$$

$$u = 4-x$$

$$du = -dx$$

$$-du = dx$$

$$x = 4-u$$

$$-\int (4-u)u^{1/2} du$$

$$-\int 4u^{1/2} - u^{3/2} du = -4u^{3/2} \left(\frac{2}{3}\right) + u^{5/2} \left(\frac{2}{5}\right) + C$$

$$\boxed{= -\frac{8}{3}(4-x)^{3/2} + \frac{2}{5}(4-x)^{5/2} + C}$$

$$\textcircled{3} \int \frac{x+5}{2x+3} dx$$

$$u = 2x+3$$

$$du = 2dx$$

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

$$x = \frac{u-3}{2}$$

$$\left(\frac{u-3}{2}\right) + \frac{5}{1}$$

$$\frac{u-3}{2} + \frac{10}{2} = \frac{u+7}{2}$$

$$\frac{1}{2} \int \left(\frac{u+7}{2}\right) \cdot \frac{1}{u} du$$

$$= \frac{1}{4} \int (u+7) \frac{1}{u} du$$

$$= \frac{1}{4} \int (1 + 7/u) du$$

$$= \frac{1}{4} [u + 7 \ln|u|] + C$$

$$\boxed{= \frac{1}{4} (2x+3 + 7 \ln(2x+3)) + C}$$

$$\textcircled{4} \int \frac{x^2+4}{x+2} dx \quad \int \frac{(u-2)^2+4}{u} du$$

$$u = x+2$$

$$du = dx$$

$$x = u-2$$

$$= \int \frac{u^2 - 4u + 4 + 4}{u} du$$

$$= \int u - 4 + 8u^{-1} du = \frac{1}{2}u^2 - 4u + 8\ln|u| + C$$

$$= \frac{1}{2}(x+2)^2 - 4(x+2) + 8\ln|x+2| + C$$

$$\textcircled{7} \int \sec^2(2x-3) dx \quad \frac{1}{2} \int \sec^2 u du$$

$$= \frac{1}{2} \tan(2x-3) + C$$

$$u = 2x-3$$

$$du = 2dx$$

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

$$\textcircled{8} \int \frac{(2-\sqrt{x})^5}{\sqrt{x}} dx$$

$$-2 \int u^5 du$$

$$= -\frac{1}{3}(2-\sqrt{x})^6 + C$$

$$u = 2-\sqrt{x}$$

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

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

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

$$\textcircled{9} \int x^2 e^{-4x^3} dx$$

$$-\frac{1}{12} \int e^u du$$

$$u = -4x^3$$

$$du = -12x^2 dx$$

$$-\frac{1}{12} du = x^2 dx$$

$$\boxed{= -\frac{1}{12} e^{-4x^3} + C}$$

$$\textcircled{10} \int e^x e^x dx$$

$$u = e^x$$

$$du = e^x dx$$

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

$$= \frac{1}{2} (e^x)^2 + C$$

$$\boxed{= \frac{1}{2} e^{2x} + C}$$

$$\textcircled{11} \int e^{2x} dx$$

$$\frac{1}{2} \int e^u du$$

$$u = 2x$$

$$du = 2 dx$$

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

$$\boxed{\frac{1}{2} e^{2x} + C}$$

or

←

$$\textcircled{11} \int \frac{1 + e^{3x}}{e^{3x} + 3x} dx$$

$$u = e^{3x} + 3x$$

$$du = 3e^{3x} + 3$$

$$\frac{1}{3} du = e^{3x} + 1$$

$$\frac{1}{3} \int \frac{1}{u} du$$

$$\boxed{\frac{1}{3} \ln|e^{3x} + 3x| + C}$$

$$\textcircled{12} \int \frac{\sin(\ln ax)}{x} dx$$

$$u = \ln ax$$

$$du = \frac{1}{ax} \cdot a = \frac{1}{x} dx$$

$$\int \sin u \, du$$

$$\boxed{-\cos|\ln ax| + C}$$