

Ex 1. Using differentials, approximate $e^{0.01}$.

Ex 2. Find the indefinite integrals

a) $\int \frac{-2\sqrt{x}}{3} dx$; b) $\int (u^e + e^u) du$

c) $\int (x^2 + 5)(x-3) dx$.

Solutions

Ex 1. Let $f(x) = e^x$. Since $0.01 = 0 + 0.01$, using differentials, we have:

$$\begin{aligned} f(0+0.01) &\approx f(0) + f'(0)(0.01) \\ &\approx e^0 + e^0(0.01) \end{aligned}$$

Therefore

$$e^{0.01} \approx 1 + 0.01 = 1.01.$$

Ex 2. a) $\int \frac{-2\sqrt{x}}{3} dx = -\frac{2}{3} \int x^{\frac{1}{2}} dx = -\frac{2}{3} \left[\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1} \right] + c$

$$= -\frac{2}{3} \frac{x^{\frac{3}{2}}}{\frac{3}{2}} + c = -\frac{4}{9} x^{\frac{3}{2}} + c$$

b) $\int (u^e + e^u) du = \int u^e du + \int e^u du$

$$= \frac{u^{e+1}}{e+1} + e^u + c.$$

$$c) \int (x^2 + 5)(x - 3) dx = \int (x^3 - 3x^2 + 5x - 15) dx$$

$$= \frac{x^4}{4} - x^3 + \frac{5}{2}x^2 - 15x + C$$