# Deffinite Integration

indeffinite integral: $\int 3x^2+2\,dx$

$\frac{\cancel{3}x^3}{\cancel{3}}+2x+c$

deffinite integration: $\int_2^5 3x^2+2\,dx$

THE FUNDAMENTAL THEOREM OF CALCULUS

$$\int_a^b f(x)\,dx = F(x)\Big]_a^b = F(b)-F(a)$$

$$f(x) = F'(x)$$

$$\int_2^5 3x^2+2\,dx = x^3+2x\cancel{+c}\Big]_2^5$$

$$= 5^3+2(5)+c-(2^3+2\cdot 2+c)$$

$$= 125+10\cancel{+c}-8-4\cancel{-c}$$

the c's cancel
this always happens,
so we can just
ignore it!!

$$=\boxed{123}$$

$$\int_1^4 3\sqrt{x}\,dx = \frac{3x^{3/2}}{3/2}\Bigg]_1^4$$

$$\frac{6x^{3/2}}{3}\Bigg]_1^4 = 2x^{3/2}\Bigg]_1^4$$

$$= 2(4)^{3/2} - 2(1)^{3/2}$$

$$2\cdot 8 - 2 = 14$$

$$\int_{-5}^{-1} 3\,dv = 3v\Big]_{-5}^{-1} = 3(-1) - 3(-5)$$

$$-3 + 15 = \boxed{12}$$

$$\cancel{= 3(-5) - 3(-1)}$$

$$\int_1^4 \frac{x-2}{\cancel{\sqrt{x}}\,x^{1/2}}\,dx$$

$$\int_1^4 x^{1/2} - \frac{2}{x^{1/2}}\,dx = \int_1^4 x^{1/2} - 2x^{-1/2}\,dx$$

$$= \frac{x^{3/2}}{3/2} - \frac{2x^{1/2}}{1/2}\Bigg]_1^4$$

$$= \frac{(4)^{3/2}}{3/2} - \frac{2(4)^{1/2}}{1/2} - \left(\frac{1^{3/2}}{3/2} - \frac{2\,1^{1/2}}{1/2}\right)$$

$$= \frac{2}{3} \qquad \frac{2}{3}\cdot 8 - 2\cdot 2\cdot 2 - \left(\frac{2}{3} - 2\cdot 2\right)$$

$$\frac{16}{3} - 8 - \frac{2}{3} + 4$$

$$\frac{14}{3} - 4$$

$$\frac{14}{3} - \frac{12}{3} = \boxed{\frac{2}{3}}$$

$$\int_0^9 \frac{x-\sqrt{x}}{3}\,dx$$

$$\frac{1}{3}\int_0^9 x - x^{1/2}\,dx = \frac{1}{3}\left(\frac{x^2}{2} - \frac{2x^{3/2}}{3}\Big]_0^9\right)$$

$$\frac{1}{3}\left(\frac{9^2}{2} - \frac{2}{3}\cdot 9^{3/2} - \cancel{\left(\frac{0^2}{2} - \frac{2\,0^{3/2}}{3}\right)}^{0}\right)$$

$$\frac{1}{3}\left(\frac{81}{3} - \frac{2}{3}27\right)$$

$$\frac{1}{3}(27-18) = \frac{1}{3}(9) = \boxed{3}$$