

### 5.3 A FTC, part 2

The Fundamental Theorem of the Calculus is used to evaluate integrals by using antiderivates

$$\int_a^b f'(x) dx = f(b) - f(a)$$

or

$$\int_a^b f(x) dx = F(b) - F(a)$$

$F(x)$  is the antiderivative of  $f(x)$

or

$$\int_a^b f(x) dx = F(x) \Big|_a^b$$

"evaluation bar"

upper minus lower

$$\begin{aligned} \text{Ex 1} \quad \int_1^3 x^3 + 4 dx &= \left. \frac{x^4}{4} + 4x \right|_1^3 \\ &= \left( \frac{3^4}{4} + 4 \cdot 3 \right) - \left( \frac{1^4}{4} + 4 \cdot 1 \right) \\ &= \frac{81}{4} + 12 - \frac{1}{4} - 4 \\ &= \frac{80}{4} + 8 = 20 + 8 = 28 \end{aligned}$$

$$\begin{aligned} \text{Ex 2} \quad \int_{-2}^1 x dx &= \left. \frac{x^2}{2} \right|_{-2}^1 \\ &= \left( \frac{1^2}{2} \right) - \left( \frac{(-2)^2}{2} \right) \\ &= \frac{1}{2} - \frac{4}{2} \\ &= -\frac{3}{2} \end{aligned}$$