6)
$$\int_{1}^{3} 3x^{2} dx = \lim_{n \to \infty} \sum_{i=1}^{n} \frac{2}{n+2i} = \lim_{n \to \infty} \frac{2}{n} \underbrace{3(1+\frac{2i}{n})^{2}}_{i=1}$$

$$= \lim_{n \to \infty} \frac{2}{n} \underbrace{\frac{3(1+\frac{4i}{n}+\frac{4i^{2}}{n^{2}})}_{i=1}}_{i=1} = \lim_{n \to \infty} \frac{2}{n^{3}} \underbrace{3n^{2}+(2in+12i^{2})}_{i=1}$$

$$= \lim_{n \to \infty} \frac{2}{n} \underbrace{\frac{3n^{3}}{3n^{2}} + \frac{12n(n+1)(2n+1)}{6}}_{i=1} + \underbrace{\frac{4n^{3}}{n^{2}} \underbrace{3n^{2}+(2in+12i^{2})}_{6}}_{i=1}$$

$$= \lim_{n \to \infty} \frac{2}{n} \underbrace{\frac{3n^{3}}{3n^{2}} + \frac{12n(n+1)(2n+1)}{6}}_{i=1}$$

$$= \lim_{n \to \infty} \frac{2}{n^{3}} \underbrace{\frac{3n^{3}}{3n^{2}} + \frac{12n(n+1)(2n+1)}{6}}_{i=1}$$