

\Rightarrow Indicates the beginning of work.

1. Evaluate the following definite integral:

$$\begin{aligned} & \int_2^{40} x^2 dx \\ \Rightarrow \frac{x^3}{3} \Big|_2^{40} &= \frac{40^3}{3} - \frac{2^3}{3} = \frac{64,000}{3} - \frac{8}{3} \\ &= \boxed{\frac{63,992}{3} \approx 21,330.\overline{66}} \end{aligned}$$

2. Evaluate the following summation:

$$\begin{aligned} & \sum_{n=0}^5 n - 1 \\ \Rightarrow (0 - 1) + (1 - 1) + (2 - 1) + (3 - 1) + (4 - 1) + (5 - 1) \\ &= 4 + 3 + 2 + 1 + 0 - 1 = \boxed{9} \end{aligned}$$

Use u substitution to evaluate the following integrals:

3.

$$\begin{aligned} & \int 3x^2(x^3 + 1)^6 dx \\ \Rightarrow u = x^3 + 1 \quad du &= (3x^2)dx \\ \int u^6 du &= \boxed{\frac{u^7}{7} + C = \frac{(x^3 + 1)^7}{7} + C} \end{aligned}$$

4.

$$\begin{aligned} & \int e^{2x} dx \\ \Rightarrow u = 2x \quad \frac{1}{2} du &= dx \\ \frac{1}{2} \int e^u du &= \boxed{\frac{e^u}{2} + C = \frac{e^{2x}}{2} + C} \end{aligned}$$

5.

$$\begin{aligned} & \int \frac{6x}{(5 + 3x^2)^4} dx \\ \Rightarrow u = 5 + 3x^2 \quad du &= 6x dx \\ = \int \frac{1}{u^4} du = \int u^{-4} du &= \boxed{-\frac{u^{-3}}{3} + C = -\frac{(5 + 3x^2)^{-3}}{3} + C} \end{aligned}$$

6.

$$\begin{aligned} & \int \frac{4 \sin(x)}{3 + \cos(x)} dx \\ \Rightarrow u = 3 + \cos(x) \quad du &= -\sin(x) dx \\ -4 \int \frac{1}{u} du &= \boxed{-4 \ln |u| + C = -4 \ln |3 + \cos(x)| + C} \end{aligned}$$
