Interlude 2: Exercise 2

Explanation

This is an exercise in using the fundamental theorem of calculus to evaluate definite integrals.

Hint

Use the fundamental theorem of calculus and the result from the previous exercise.

Answer

- $f(t) = t^4$

The result from Exercise 1, but with limits of integration from 0 to T

$$\int_0^T t'^4 \, dt' = \frac{t^5}{5}\bigg|_0^T = \frac{T^5}{5} - 0 = \frac{T^5}{5}.$$

- $f(t) = \cos t$

The result from Exercise 1, but with limits of integration from 0 to T

$$\int_0^T \cos t \, d\, t = \sin t \Big|_0^T = \sin T + \sin 0 = \sin T.$$

- **$f(t) = t^2 - 2$**

The result from Exercise 1, but with limits of integration from 0 to T

$$\int_0^T \left(t^2 - 2\right) d\, t = \left(\frac{t^3}{3} - 2\, t\right)\Big|_0^T = \frac{T^3}{3} - 2\, T - 0 = \frac{T^3}{3} - 2\, T.$$