1. What is $\int_0^{10}(x-5)+(x-5)^2+(x-5)^3\,dx$?

2. Find the maximum value of
$$\int_{-\pi/2}^{3\pi/2}\sin(x)f(x)\,dx$$
subject to the constraint $|f(x)|\le 5$.

3. Calculate
$$\int_{2^5}^{3^5}\frac{1}{x-x^{3/5}}\,dx.$$

4. Compute the x-coordinate of the point on the curve $y=\sqrt{x}$ that is closest to the point $(2,1)$.

5. Let
$$f(x)=x+\frac{x^2}{2}+\frac{x^3}{3}+\frac{x^4}{4}+\frac{x^5}{5},$$
and set $g(x)=f^{-1}(x)$. Compute $g^{(3)}(0)$.

6. Compute
$$\lim_{x\to 0}\left(\frac{\sin x}{x}\right)^{\frac{1}{1-\cos x}}.$$

7. A differentiable function g satisfies
$$\int_0^x(x-t+1)g(t)\,dt=x^4+x^2$$
for all $x\ge 0$. Find $g(t)$.

8. Compute
$$\int_0^{\infty}\frac{\ln x}{x^2+4}\,dx.$$

9. Find the ordered pair (α,β) with non-infinite $\beta\neq 0$ such that $\lim_{n\to\infty}\dfrac{\sqrt[n^2]{1!2!\cdots n!}}{n^\alpha}=\beta$ holds.

10. Find the maximum of
$$\int_0^1 f(x)^3\,dx$$
given the constraints
$$-1\le f(x)\le 1,\quad \int_0^1 f(x)\,dx=0.$$