Question 1

$$\alpha = \int_0^1 xe^{\frac{x^2-1}{2}} \cos(x)dx$$

$$\beta = \int_1^{3/2} e^{2(x^2-2x)} \sqrt{1-\cos(4x-4)}dx$$

Find $\dfrac{\alpha - \cos(1) + e^{-1/2}}{\beta}$

Question 2

$$\psi(x) = \lim_{n\to\infty} \int_0^x \sum_{k=1}^{n} \frac{1}{2^k(1+t^k)}dt$$

If $\psi(x) = \sum_{n=0}^{\infty} a_n x^n$ for $|x| < 1$, then find the value of $a_0 + a_1 + a_2$

Question 3

$$f(x,y) := \frac{x}{x^2+y^2} \text{ and } g(x,y) := \frac{-y}{x^2+y^2}$$

$$P(x,y) = \int_0^y \frac{\partial f(x,t)}{\partial x} \partial t - g(x,y)$$

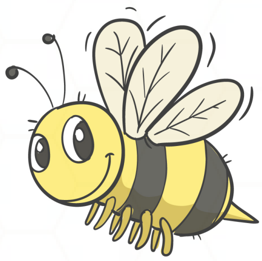
$$Q(x,y) = \int_0^x \frac{\partial g(t,y)}{\partial y} \partial t - f(x,y)$$

Find $\int_1^2 \left(\frac{\partial P}{\partial x}\right) \partial y + \int_2^3 \left(\frac{\partial Q}{\partial y}\right) \partial x$

Question 4

$$\int_1^2 \ln x \left(\left(\frac{x}{e}\right)^x + \left(\frac{e}{x}\right)^x\right) dx$$

Question 5

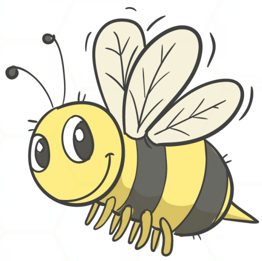


$$\int_0^1 \left(1 + \frac{x^5}{5!} + \frac{x^{10}}{10!} + \dots\right) dx$$

Question 6

$$\int_0^\infty e^{-x^2} \cos(5x) dx$$

Question Buffer R3 7



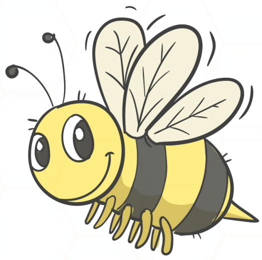
$$\int_0^1 \sqrt{\frac{x}{1-x}} \ln\left(\sqrt{\frac{x}{1-x}}\right) dx$$

Question Buffer R3 8

Find the value of

$$\int_0^{\frac{\pi}{4}} \left(\frac{x^{10}}{1+x^6}\right)^2 dx$$

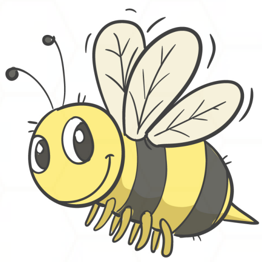
Question Buffer R3 9



Find the value of

$$\int \log(x)\sin^{-1}(x)dx$$

Question Round 4



$$\int (9x^9 - x^{90} + 9x^{99} - x^{900} + 9x^{909} - x^{990} + 9x^{999} - x^{9000} + \dots)\,dx$$

Question Round 4

Find the value of

$$\int_0^{\infty} \frac{\log(2x)}{\sqrt{x+1}\sqrt{x}\sqrt{2x+1}} dx$$

Given that $\beta\left(m,n\right) = \int_0^1 x^{m-1}(1-x)^{n-1} dx$

Question Round 4

$$\int_0^{\infty} \ln(1-e^{-x})\, dx$$

Question Round 4

$$\int e^{\cos x} \cos(2x + \sin x)\, dx$$

Question buffer

If $f(x, y) = \sin(x + \pi/2) + \cos(y)$ is

a function defined over $x \geq 0$, $y \geq 0$, $x + y \leq \pi$,

The intersection of $f(x, y)$ and the plane

$y = (\tan\theta)x$ is defined as $F(x, \theta)$ on that plane

$$\forall\ \pi/2 \geq \theta \geq 0$$

Find $\displaystyle\int_0^{\pi/2} \int_0^{2} F^{-1}(x, \theta) dx d\theta$