SwInBee 2022

Name:

Instructions

1. Duration: up to 45 minutes to answer questions on pen and paper, then 15 minutes to enter your answers into the online checker.
2. 1 point for each correct answer, no guessing! Working must be provided to demonstrate that the correct answer has been obtained via a valid mathematical method. (Guesses are identified at the marker's discretion; basically we want to discourage writing "π" for each integral that you can't figure out.)
3. Materials allowed are pens and pencils. We'll supply paper for rough working.
4. Record your answers on this answer sheet.
5. After the 45 minutes is up (or earlier if you choose) you need to login to the SMMC Canvas shell and enter your answers into the SwInBee assignment. **Your submitted answers must match the answers which you wrote by hand on your answer sheet**.
6. Your answers should be entered as mathematical expressions, without the +C of indefnite integrals. E.g., if your answer is $\sin(2x) + C$, then the checker would record any of "sin(2x)" and "2 sin(x) cos(x)" and " π sin(2x) / π" as correct.
7. In the event of papers achieving the same score, the tie-breaker will be the order of submission, with earlier papers ranked higher.

Integrals

1. $\displaystyle\int (7x+\sqrt{2})^e\,dx = \frac{1}{7(e+1)}(7x+\sqrt{2})^{e+1} + C$

2. $\displaystyle\int \cos^3 x\,dx = \sin x - \frac{1}{3}\sin^3 x + C$

3. $\displaystyle\int \frac{2x+3}{(x-1)^2}\,dx = -\frac{5}{x-1} + 2\ln(x-1) + C$

4. $\displaystyle\int \sqrt{x\sqrt[3]{x\sqrt[4]{x\sqrt[5]{x\cdots}}}}\,dx = \frac{x^{e-1}}{e-1} + C$

5. $\displaystyle\int \ln(1+x^2)\,dx = x\ln(1+x^2) + 2\arctan x - 2x + C$

6. $\displaystyle\int_0^{\pi/4} \frac{\sin^3 x}{\sqrt[3]{\cos x}}\,dx = \frac{8}{5} - \frac{9}{5}\cdot\frac{1}{2^{1/4}}$

7. $\displaystyle\int_0^{\pi/2} \left(\frac{(2x)^2}{2!} - \frac{(2x)^4}{4!} + \frac{(2x)^6}{6!} - \frac{(2x)^8}{8!} + \cdots \right) \sin x \, dx = \frac{4}{3}$

8. $\displaystyle\int \frac{1}{4+9x^2} \, dx = \frac{1}{6} \arctan\left(\frac{3x}{2}\right) + C$

9. $\displaystyle\int \frac{1}{x^2+5x+6} \, dx = \ln(x+2) - \ln(x+3) + C$

10. $\displaystyle\int \left(\frac{\cos x \tan x}{x \sin x} \right)^2 \, dx = -\frac{1}{x} + C$

11. $\displaystyle\int \frac{1}{\sqrt{\sqrt{x}-1}} \, dx = \frac{4}{3}\sqrt{\sqrt{x}-1}(\sqrt{x}+2) + C$

12. $\displaystyle\int \frac{x}{1+x^4} \, dx = \frac{1}{2} \arctan(x^2) + C$

13. $\displaystyle\int_{-\pi}^{\pi} x^3 \cos x \sin^4 x \, dx = 0$

14. $\displaystyle\int (\ln x)^3 \, dx = -6x + 6x \ln x - 3x(\ln x)^2 + x(\ln x)^3 + C$

15. $\displaystyle\int \frac{1}{\ln x} - \frac{1}{(\ln x)^2} \, dx = \frac{x}{\ln x} + C$

16. $\displaystyle\int e^{-2x} \cos(3x) \, dx = \frac{1}{13} e^{-2x}(-2\cos(3x) + 3\sin(3x)) + C$

17. $\displaystyle\int \sin x \cos(\cos x) \sin(\sin(\cos x)) \, dx = \cos(\sin(\cos x)) + C$

18. $\displaystyle\int x^2 \ln x \, dx = -\frac{x^3}{9} + \frac{1}{3} x^3 \ln x + C$