The ProbLemma's Channel Integrals

This document links all the integrals evaluated on the ProbLemma channel to the episodes in which these evaluations were carried out.


In addition, all the integral related episodes are collected in the "Integrals Are Us" play list.

1. Season 2 Episode 15 (S2M17): Fourier Series of $\log(\Gamma(x))$ over $(0,1]$

$$\int_0^1 \log(\Gamma(x))\,dx = \log(\sqrt{2\pi})$$

$$\int_0^1 \log(\Gamma(x))\cos(2n\pi x)\,dx = \frac{1}{4n},\ n = 1,2,3,\ldots$$

$$\int_0^1 \log(\Gamma(x))\sin(2n\pi x)\,dx = \frac{\gamma + \log(2n\pi)}{2n\pi},\ n = 1,2,3,\ldots$$

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2. Season 2 Episode 19 (S2M21): Effectiveness Of Advertisement (Equation)

$$\int \frac{1}{x(a-x)}\,dx = \frac{1}{a}\log\left(\left|\frac{x}{a-x}\right|\right) + C$$

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3. Season 2 Episode 20 (S2M22): Fresnel Integrals Via Equations (Equation)

$$\int_0^{+\infty} e^{-ax^2}\cos(bx^2)\,dx = \frac{1}{2}\sqrt{\frac{\pi}{2}}\cdot\sqrt{\frac{a+\sqrt{a^2+b^2}}{a^2+b^2}},\ a>0, b\geqslant 0$$

$$\int_0^{+\infty} e^{-ax^2}\sin(bx^2)\,dx = \frac{1}{2}\sqrt{\frac{\pi}{2}}\cdot\sqrt{\frac{-a+\sqrt{a^2+b^2}}{a^2+b^2}},\ a>0, b\geqslant 0$$

$$\int_0^{+\infty} \cos\left(x^2\right) dx = \int_0^{+\infty} \sin\left(x^2\right) dx = \frac{1}{2}\sqrt{\frac{\pi}{2}}$$

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4. Season 2 Episode 24 (S2M26): Integral Evaluation via Scope Reduction (Scope Reduction)

$$\int_c^{2c} \frac{x}{\sqrt{x^2 + cx - 2c^2}} dx = 2c - \frac{c}{2} \log(3)$$

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5. Season 2 Episode 30 (S2M32): Exponometric Integrals (Scope Expansion)

$$\int e^{ax} \sin(bx) \cos(cx) dx =$$

$$= e^{px} \left(\frac{a \sin((b+c)x) - (b+c) \cos((b+c)x)}{a^2 + (b+c)^2} + \frac{a \sin((b-c)x) - (b-c) \cos((b-c)x)}{a^2 + (b-c)^2} \right) + C$$
