The 5^{th} Annual Integration Bee

Youngstown State University

Sponsored by the Department of Mathematics and Statistics

Slide Format inspired by Daniel DeChellis & Justin Hosseininejad

Special Thanks to all of our judges and to all of you for participating!

April 15, 2010

Problem #1

- PROBLEM:

$$\int x^5 \, dx$$

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- ANSWER:

$$\frac{1}{6}x^6 + C$$

Problem #2

- PROBLEM:

$$\int x^3 \cos(x^4)\, dx$$

Problem #2

- PROBLEM:

$$\int x^3 \cos(x^4)\, dx$$

- ANSWER:

$$\frac{1}{4}\sin(x^4) + C$$

Problem #3

- PROBLEM:

$$\int \sec(\cos x)\tan(\cos x)\sin x\,dx$$

Problem #3

- PROBLEM:

$$\int \sec(\cos x)\tan(\cos x)\sin x\,dx$$

- ANSWER:

$$-\sec(\cos x) + C$$

Problem #4

- PROBLEM:

$$\int \frac{x^5 + 5}{x}\, dx$$

Problem #4

- PROBLEM:

$$\int \frac{x^5 + 5}{x}\, dx$$

- ANSWER:

$$\frac{1}{5}x^5 + 5\ln(|x|) + C$$

Problem #5

- PROBLEM:

$$\int \frac{x+2}{x+1}\,dx$$

Problem #5

- PROBLEM:

$$\int \frac{x+2}{x+1}\,dx$$

- ANSWER:

$$x + \ln(|x+1|) + C$$

or

$$x + 1 + \ln(|x+1|) + C$$

Problem #6

- PROBLEM:

$$\int xe^{2x}\,dx$$

Problem #6

- PROBLEM:

$$\int xe^{2x}\,dx$$

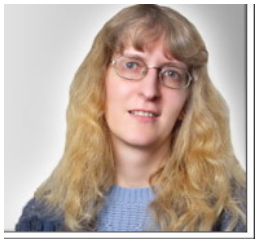
- ANSWER:

$$\frac{1}{2}xe^{2x} - \frac{1}{4}e^{2x} + C$$

Problem #7

- PROBLEM:

$$\int \sin^8(x)\cos^3(x)\,dx$$



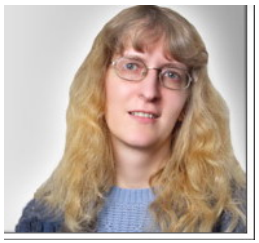
Problem #7

- PROBLEM:

$$\int \sin^8(x)\cos^3(x)\,dx$$

- ANSWER:

$$\frac{1}{9}\sin^9(x) - \frac{1}{11}\sin^{11}(x) + C$$



Problem #8

- PROBLEM:

$$\int \frac{6x-2}{x^2+2x-15}\,dx$$

Problem #8

- PROBLEM:

$$\int \frac{6x-2}{x^2+2x-15}\,dx$$

- ANSWER:

$$2\ln(|x-3|)+4\ln(|x+5|)+C$$

Problem #9

- PROBLEM:

$$\int \frac{x^2}{\sqrt{1-x^2}}\,dx$$

Problem #9

- PROBLEM:

$$\int \frac{x^2}{\sqrt{1-x^2}}\,dx$$

- ANSWER:

$$\frac{1}{2}\arcsin(x) - \frac{1}{2}x\sqrt{1-x^2} + C$$

or

$$-\frac{1}{2}\arccos(x) - \frac{1}{2}x\sqrt{1-x^2} + C$$

Problem #10

- PROBLEM:

$$\int \frac{e^x}{1+e^{2x}}\,dx$$

Problem #10

- PROBLEM:

$$\int \frac{e^x}{1+e^{2x}}\,dx$$

- ANSWER:

$$\arctan(e^x) + C$$

Problem #11

- PROBLEM:

$$\int e^{\sqrt{x}}\, dx$$

Problem #11

- PROBLEM:

$$\int e^{\sqrt{x}}\, dx$$

- ANSWER:

$$2e^{\sqrt{x}}(\sqrt{x}-1)+C$$

Problem #12

- PROBLEM:

$$\int \frac{1}{x - \sqrt{x+2}}\, dx$$

Problem #12

- PROBLEM:

$$\int \frac{1}{x - \sqrt{x+2}}\, dx$$

- ANSWER:

$$\frac{4}{3}\ln(|\sqrt{x+2} - 2|) + \frac{2}{3}\ln(|\sqrt{x+2} + 1|) + C$$

Problem #13

- PROBLEM:

$$\int \frac{\sqrt{x}}{1+x^3}\,dx$$

Problem #13

- PROBLEM:

$$\int \frac{\sqrt{x}}{1+x^3}\,dx$$

- ANSWER:

$$\frac{2}{3}\arctan\left(x^{\frac{3}{2}}\right)+C$$

Problem #14

- PROBLEM:

$$\int (x^3 - 3x^2 + 3x + 6)^4 (x-1)^2 \, dx$$

Problem #14

- PROBLEM:

$$\int (x^3 - 3x^2 + 3x + 6)^4 (x - 1)^2 \, dx$$

- ANSWER:

$$\frac{1}{15} (x^3 - 3x^2 + 3x + 6)^5 + C$$

Problem #15

- PROBLEM:

$$\int \sin(\ln(x))\, dx$$

Problem #15

- PROBLEM:

$$\int \sin(\ln(x))\, dx$$

- ANSWER:

$$\frac{1}{2}x(\sin(\ln(x)) - \cos(\ln(x))) + C$$

Problem #16

- PROBLEM:

$$\int \frac{1}{\sqrt[3]{x}+2}\,dx$$

Problem #16

- PROBLEM:

$$\int \frac{1}{\sqrt[3]{x}+2}\,dx$$

- ANSWER:

$$\frac{3}{2}x^{2/3} - 6x^{1/3} + 12\ln\left|x^{1/3}+2\right| + C$$

Problem #17

- PROBLEM:

$$\int \frac{\sqrt{x+1}}{x}\, dx$$

Problem #17

- PROBLEM:

$$\int \frac{\sqrt{x+1}}{x}\,dx$$

- ANSWER:

$$2\sqrt{x+1} + \ln(|\sqrt{x+1}-1|) - \ln(\sqrt{x+1}+1) + C$$

Problem #18

- PROBLEM:

$$\int \frac{x}{x^2 + 4x + 9}\, dx$$

Problem #18

- PROBLEM:

$$\int \frac{x}{x^2+4x+9}\,dx$$

- ANSWER:

$$\frac{1}{2}\ln(x^2+4x+9) - \frac{2}{\sqrt{5}}\arctan\left(\frac{x+2}{\sqrt{5}}\right) + C$$

Problem #19

- PROBLEM:

$$\int \frac{1}{(5-4x-x^2)^{\frac{5}{2}}}\,dx$$

Problem #19

- PROBLEM:

$$\int \frac{1}{(5-4x-x^2)^{\frac{5}{2}}}\,dx$$

- ANSWER:

$$\frac{1}{243}\left(\frac{(x+2)^3}{(5-4x-x^2)^{\frac{3}{2}}}+\frac{3(x+2)}{\sqrt{5-4x-x^2}}\right)+C$$