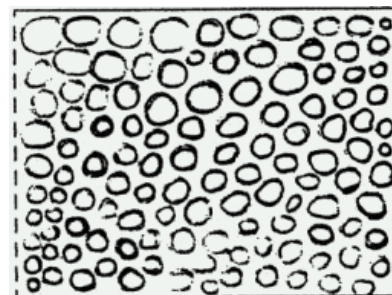


# A Doodle for Integration Techniques

by David H. Pleacher in the *Virginia Mathematics Teacher* Fall 1991

Directions:

Solve each of the integration problems and locate the letters of the corresponding answer. Then in the spaces below, write the letter that corresponds to each number. This will give you the titles of the doodle (this doodle is from a book called *Doodles* by Roger Price).



Title 1:  $\frac{\quad}{10}$   $\frac{\quad}{23}$   $\frac{\quad}{14}$        $\frac{\quad}{23}$   $\frac{\quad}{20}$        $\frac{\quad}{6}$   $\frac{\quad}{21}$   $\frac{\quad}{11}$   $\frac{\quad}{6}$   $\frac{\quad}{19}$   $\frac{\quad}{5}$   $\frac{\quad}{8}$

$\frac{\quad}{13}$   $\frac{\quad}{23}$   $\frac{\quad}{14}$  .

Title 2:  $\frac{\quad}{20}$   $\frac{\quad}{1}$   $\frac{\quad}{16}$   $\frac{\quad}{11}$   $\frac{\quad}{8}$   $\frac{\quad}{7}$        $\frac{\quad}{25}$   $\frac{\quad}{12}$   $\frac{\quad}{26}$   $\frac{\quad}{6}$   $\frac{\quad}{5}$   $\frac{\quad}{3}$

$\frac{\quad}{4}$   $\frac{\quad}{3}$   $\frac{\quad}{12}$   $\frac{\quad}{20}$   $\frac{\quad}{20}$   $\frac{\quad}{11}$   $\frac{\quad}{6}$        $\frac{\quad}{2}$   $\frac{\quad}{12}$   $\frac{\quad}{24}$  .

Title 3:  $\frac{\quad}{25}$   $\frac{\quad}{6}$   $\frac{\quad}{3}$   $\frac{\quad}{11}$   $\frac{\quad}{13}$   $\frac{\quad}{4}$        $\frac{\quad}{20}$   $\frac{\quad}{23}$   $\frac{\quad}{3}$        $\frac{\quad}{12}$

$\frac{\quad}{25}$   $\frac{\quad}{13}$   $\frac{\quad}{23}$   $\frac{\quad}{4}$        $\frac{\quad}{12}$   $\frac{\quad}{8}$   $\frac{\quad}{8}$   $\frac{\quad}{23}$   $\frac{\quad}{26}$   $\frac{\quad}{8}$   $\frac{\quad}{6}$   $\frac{\quad}{5}$  -

$\frac{\quad}{24}$   $\frac{\quad}{5}$   $\frac{\quad}{8}$   $\frac{\quad}{4}$  .

Title 4:  $\frac{\quad}{25}$   $\frac{\quad}{13}$   $\frac{\quad}{23}$   $\frac{\quad}{4}$   $\frac{\quad}{25}$        $\frac{\quad}{20}$   $\frac{\quad}{23}$   $\frac{\quad}{3}$        $\frac{\quad}{12}$   $\frac{\quad}{8}$

$\frac{\quad}{12}$   $\frac{\quad}{1}$   $\frac{\quad}{10}$   $\frac{\quad}{11}$   $\frac{\quad}{6}$   $\frac{\quad}{23}$        $\frac{\quad}{1}$   $\frac{\quad}{5}$   $\frac{\quad}{23}$   $\frac{\quad}{13}$   $\frac{\quad}{12}$   $\frac{\quad}{3}$   $\frac{\quad}{17}$  .

## Problems

\_\_\_\_\_1.  $\int_{-1}^8 \frac{|x|}{x} dx$

\_\_\_\_\_2.  $\int \sqrt{\sin x} \cos x dx$

\_\_\_\_\_3.  $\int_{-3}^3 (x - \sin x) dx$

\_\_\_\_\_4.  $\int_0^1 \frac{e^x + 3}{e^x} dx$

\_\_\_\_\_5.  $\int_1^e \frac{dx}{x}$

\_\_\_\_\_6.  $\int_0^2 \frac{x}{x^2 + 2} dx$

\_\_\_\_\_7.  $\int_0^{\ln 3} e^{2x} dx$

\_\_\_\_\_8.  $\int_0^{\pi/2} e^{\cos x} \sin x dx$

\_\_\_\_\_9.  $\int_{1/3}^0 (3x - 1)^5 dx$

\_\_\_\_\_10.  $\int_0^1 (x + 1)e^{x^2 + 2x} dx$

\_\_\_\_\_11.  $\int_0^{\pi/4} \tan^2 x dx$

\_\_\_\_\_12.  $\int_0^{1/2} \frac{2x dx}{\sqrt{1 - x^2}}$

\_\_\_\_\_13.  $\int \frac{5}{1 + x^2} dx$

\_\_\_\_\_14.  $\int_1^2 \frac{x - 4}{x^2} dx$

\_\_\_\_\_15.  $\int \frac{\ln x}{x} dx$

\_\_\_\_\_16.  $\int \tan x dx$

\_\_\_\_\_17.  $\int x \ln x dx$

\_\_\_\_\_18.  $\int e^x \cos x dx$

\_\_\_\_\_19.  $\int \sec x dx$

\_\_\_\_\_20.  $\int \ln x dx$

\_\_\_\_\_21.  $\int \frac{x^3 - 2x + 3}{x^2 - 2x - 3} dx$

\_\_\_\_\_22.  $\int \frac{x}{x + 2} dx$

\_\_\_\_\_23.  $\int x^2 e^x dx$

\_\_\_\_\_24.  $\int \sqrt[3]{\sin x} \cos x dx$

\_\_\_\_\_25.  $\int \frac{dx}{x^2 + 4x}$

\_\_\_\_\_26.  $\int \frac{x^2 - x + 2}{x^2 - 1} dx$

## Answers

A.  $2 - \sqrt{3}$

B.  $\frac{e^3 - 1}{2}$

C.  $\ln \sqrt{3}$

D.  $\frac{1}{4}x^2(2\ln x - 1) + C$

E. 1

F.  $x \ln |x| - x + C$

G. 4

H.  $\frac{1}{2}x^2 + 2x - \ln|x+1| + 6\ln|x-3| + C$

I.  $1 - \frac{\pi}{4}$

J.  $\frac{2}{3}(\sin x)^{\frac{3}{2}} + C$

K.  $\ln |\sec x + \tan x| + C$

L. 7

$$\text{M. } \frac{3}{4}(\sin x)^{\frac{4}{3}} + C$$

$$\text{N. } -1 + e$$

$$\text{O. } (x^2 - 2x + 2)e^x + C$$

$$\text{P. } 5 \tan^{-1} x + C$$

$$\text{Q. } \frac{1}{2}(\ln|x|)^2 + C$$

$$\text{R. } 0$$

$$\text{S. } \frac{1}{4} \ln \left| \frac{x}{x+4} \right| + C$$

$$\text{T. } 4 - \frac{3}{e}$$

$$\text{U. } x + \ln \left| \frac{x-1}{(x+1)^2} \right| + C$$

$$\text{V. } \frac{1}{18}$$

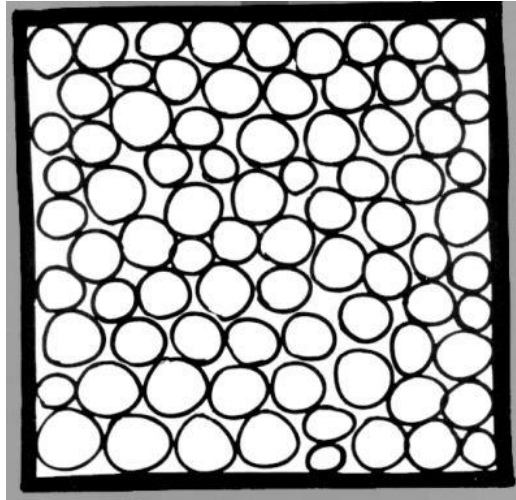
$$\text{W. } x - 2 \ln|x+2| + C$$

$$\text{X. } \ln 2 - 2$$

$$\text{Y. } \ln|\sec x| + C$$

$$\text{Z. } \frac{1}{2}e^x(\sin x + \cos x) + C$$

Here are some other titles for this Doodle from Roger Price:



Title 5:  $\frac{6}{6} \frac{1}{23} \frac{25}{25} \frac{5}{5} - \frac{26}{26} \frac{13}{13} \frac{23}{23} \frac{20}{20} \frac{4}{4} \frac{21}{21} \frac{5}{5} \frac{20}{20} \frac{1}{1} \frac{12}{12} \frac{7}{7} \frac{26}{26} \frac{25}{25} \frac{5}{5} \frac{17}{17} \frac{12}{12} \frac{4}{4}$   
 $\frac{6}{6} \frac{26}{26} \frac{25}{25} \frac{4}{4} \frac{5}{5} \frac{3}{3} \frac{25}{25} \frac{1}{1} \frac{12}{12} \frac{25}{25} \frac{4}{4} \frac{25}{25} \frac{4}{4} \frac{12}{12} \frac{8}{8} \frac{17}{17}$

Title 6:  $\frac{4}{4} \frac{3}{3} \frac{12}{12} \frac{6}{6} \frac{16}{16} \frac{25}{25} \frac{1}{1} \frac{5}{5} \frac{20}{20} \frac{4}{4} \frac{10}{10} \frac{19}{19} \frac{13}{13} \frac{23}{23} \frac{7}{7} \frac{23}{23} \frac{25}{25} \frac{4}{4} \frac{11}{11} \frac{6}{6} \frac{16}{16} \frac{13}{13} \frac{12}{12} \frac{3}{3} \frac{12}{12} \frac{17}{17} \frac{5}{5}$

Title 7:  $\frac{9}{9} \frac{5}{5} \frac{3}{3} \frac{19}{19} \frac{6}{6} \frac{1}{1} \frac{23}{23} \frac{25}{25} \frac{5}{5} - \frac{26}{26} \frac{13}{13} \frac{23}{23} \frac{20}{20} \frac{20}{20} \frac{3}{3} \frac{5}{5} \frac{6}{6} \frac{16}{16} \frac{1}{1} \frac{5}{5} \frac{6}{6} \frac{21}{21} \frac{12}{12} \frac{24}{24} \frac{13}{13}$

Title 8:  $\frac{7}{7} \frac{23}{23} \frac{13}{13} \frac{21}{21} \frac{5}{5} \frac{3}{3} \frac{21}{21} \frac{23}{23} \frac{26}{26} \frac{25}{25} \frac{11}{11} \frac{8}{8} \frac{7}{7} \frac{17}{17} \frac{5}{5} \frac{9}{9} \frac{5}{5} \frac{1}{1} \frac{23}{23} \frac{13}{13} \frac{24}{24} \frac{5}{5} \frac{8}{8} \frac{4}{4}$

Title 9:  $\frac{5}{5} \frac{14}{14} \frac{13}{13} \frac{1}{1} \frac{23}{23} \frac{25}{25} \frac{11}{11} \frac{23}{23} \frac{8}{8} \frac{11}{11} \frac{8}{8} \frac{12}{12} \frac{13}{13} \frac{11}{11} \frac{18}{18} \frac{18}{18} \frac{12}{12} \frac{20}{20} \frac{12}{12} \frac{6}{6} \frac{4}{4} \frac{23}{23} \frac{3}{3} \frac{19}{19}$

Title 10:  $\frac{17}{17} \frac{23}{23} \frac{11}{11} \frac{4}{4} - \frac{19}{19} \frac{23}{23} \frac{26}{26} \frac{3}{3} \frac{25}{25} \frac{5}{5} \frac{1}{1} \frac{20}{20} \frac{25}{25} \frac{22}{22} \frac{11}{11} \frac{25}{25} \frac{25}{25} \frac{6}{6} \frac{21}{21} \frac{5}{5} \frac{5}{5} \frac{25}{25} \frac{5}{5} \frac{16}{16} \frac{11}{11} \frac{4}{4}$

Title 11:  $52 - \frac{3}{3} \frac{11}{11} \frac{8}{8} \frac{7}{7} \frac{20}{20} \frac{1}{1} \frac{5}{5} \frac{12}{12} \frac{6}{6} \frac{11}{11} \frac{3}{3} \frac{6}{6} \frac{26}{26} \frac{25}{25}$

Title 12:  $\frac{23}{23} \frac{26}{26} \frac{4}{4} \frac{25}{25} \frac{11}{11} \frac{17}{17} \frac{5}{5} \frac{22}{22} \frac{23}{23} \frac{3}{3} \frac{1}{1} \frac{17}{17} \frac{12}{12} \frac{25}{25} \frac{25}{25} \frac{5}{5} \frac{5}{5} \frac{8}{8} \frac{10}{10} \frac{19}{19} \frac{12}{12} \frac{24}{24} \frac{12}{12} \frac{8}{8}$

$\frac{1}{1} \frac{11}{11} \frac{9}{9} \frac{11}{11} \frac{8}{8} \frac{7}{7} \frac{11}{11} \frac{8}{8} \frac{12}{12} \frac{25}{25} \frac{12}{12} \frac{1}{1} \frac{4}{4} \frac{25}{25} \frac{21}{21} \frac{12}{12} \frac{16}{16} \frac{5}{5} \frac{3}{3}$