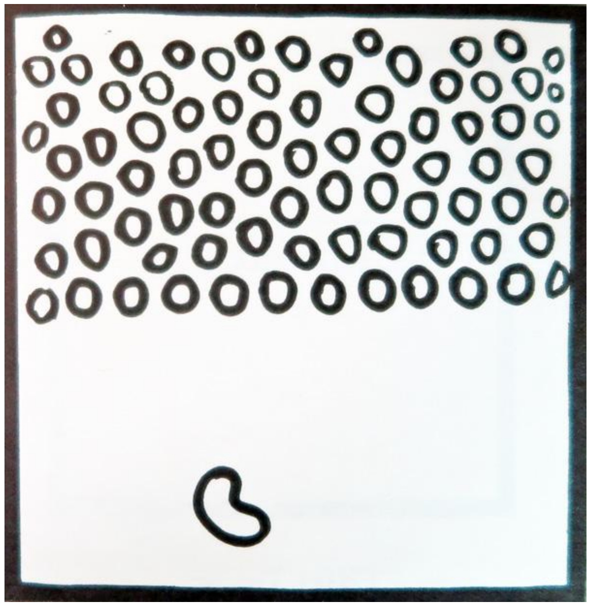
A Droodle for the A.P. Calculus Exam

A puzzle by David Pleacher



"A Droodle is a borkley looking sort of drawing that doesn't make any sense until you know the correct title." – Roger Price

<u>Caption for the picture:</u>

"__ __ __ __ __ __ __ __ __   __ __ __ __   __ __ __ __ __ __
6 4 11 8 12 3 11 12 16   13 9 4 2   11 8 7 12 2 5

__ __   __ __ __ __   __ __ __   __ __ __ __   __ __ __ __ __."
11 3   1 3 12 2   11 10 9   6 9 4 14   16 3 8 6 14

To determine the title to this droodle, which was created by Roger Price and published in his book called *Droodles*, solve the A.P. Calculus problems (from the 1993 AB Exam).
Then find the answers to each problem from the choices below.
Replace each numbered blank with the letter corresponding to the answer for that problem.
A calculator should not be used on this part of the exam.

___ 1. If $f(x) = x^{\frac{3}{2}}$, then $f'(4) =$

___ 2. $\lim\limits_{n \to 0} \dfrac{7n^3 - 5n}{n^3 - 2n^2 + 1} =$

___ 3. If $x^3 + 3xy + 2y^3 = 17$, then in terms of x and y, $\dfrac{dy}{dx} =$

___ 4. If the function *f* is continuous for all real numbers and if $f(x) = \dfrac{x^2 - 4}{x + 2}$ when $x \neq 2$,

Then $f(-2) =$

___ 5. The area of the region enclosed by the curve $y = \dfrac{1}{x - 1}$, the x-axis, and the lines x = 3

and x = 4 is

___ 6. An equation of the line tangent to the graph of $y = \dfrac{2x + 3}{3x - 2}$ at the point (1, 5) is

___ 7. If $y = \tan x - \cot x$, then $\dfrac{dy}{dx} =$

___ 8. If *h* is the function given by $h(x) = f(g(x))$, where $f(x) = 3x^2 - 1$ and $g(x) = |x|$,

then $h(x) =$

___ 9. If $f(x) = (x - 1)^2 \sin x$, then $f'(0) =$

___ 10. The acceleration of a particle moving along the x-axis at time t is given by $a(t)=6t-2$. If the velocity is 25 when t = 3 and the position is 10 when t = 1, Then the position $x(t)=$

___ 11. $\int \frac{3x^2}{\sqrt{x^3+1}}\,dx =$

___ 12. For what value of x does the function $f(x)=(x-2)(x-3)^2$ have a relative maximum?

___ 13. The slope of the <u>normal</u> to the graph of $y=2\ln(\sec x)$ at $x=\frac{\pi}{4}$ is

___ 14. $\int (x^2+1)^2\,dx =$

___ 15. $\frac{d}{dx}\int_0^x \cos(2\pi u)\,du$

___ 16. What is the minimum value of $f(x)=x\ln x$?

The droodle used in this puzzle was drawn by Roger Price and appeared in his book called *Droodles.*

Answers: (units have been omitted)

A. -4

B. $-\frac{1}{2}$

C. $-\frac{1}{e}$

D. -3

E. 1

F. 0

G. $\ln\frac{3}{2}$

H. $t^3 - t^2 + 4t + 6$

I. $\frac{7}{3}$

J. 3

K. $3x^2|x| - 1$

L. $-\frac{x^2 + y}{x + 2y}$

M. nonexistent

N. 7

O. $-\frac{x^2 + y}{x + 2y^2}$

P. 13x + y = 18

Q. $\sqrt{x^3 + 1} + C$

R. $3x^2 - 1$

S. $\frac{x^5}{5} + \frac{2x^2}{3} + x + C$

T. $2\sqrt{x^3 + 1} + C$

U. $t^3 - t^2 + 9t - 20$

V. $\ln\frac{2}{3}$

W. $\frac{1}{2\pi}\cos(2\pi x)$

X. $\cos(2\pi x)$

Y. $\sec^2 x + \csc^2 x$

Z. None of the above