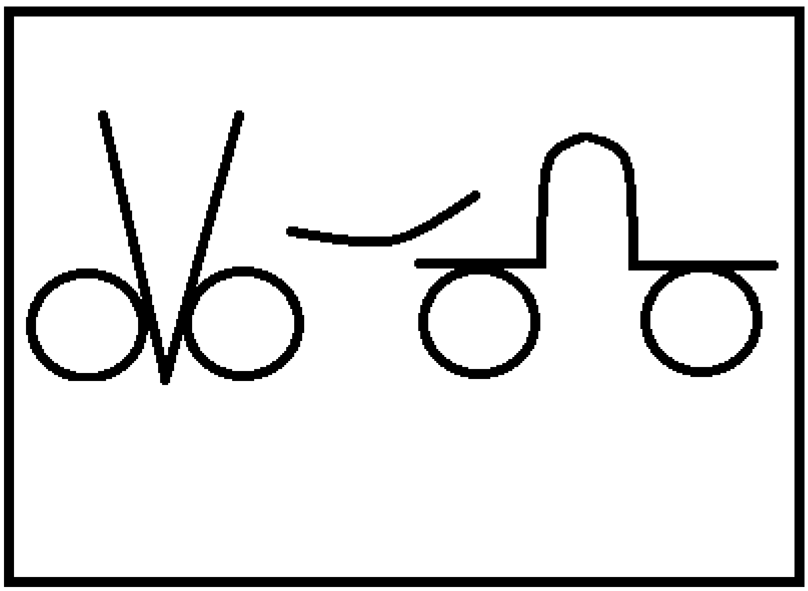
Droodle for Derivatives

A Puzzle by David Pleacher

Grade Level: Calculus

Objective: The student will be able to solve derivative problems including tangents and normals and other applications.

Can you name this droodle?



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10   3 15 2 9 4 10 8 15 7   14 11 2 2 12 7 8   10

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1 15 5 12 2 6   15 13 1

Back in 1953, Roger Price invented a minor art form called the Droodle, which he described as "a borkley-looking sort of drawing that doesn't make any sense until you know the correct title." This Droodle was drawn by Linda Wilson of Efland, North Carolina. First, you must solve the 15 problems in the puzzle and find the corresponding answers. Then replace each numbered blank in the puzzle with the letter corresponding to the answer for that problem and that will give you the title to the droodle.

1. Graph the two parabolas $y = x^2$ and $y = -x^2 + 2x - 5$. find the equations of the lines that are simultaneously tangent to both parabolas.

2. Determine the value of k so that the line $y = 5x - 4$ is tangent to the graph of the function $f(x) = x^2 - kx$.

3. An object travels along a line so that its distance traveled in inches after *t* seconds is $s(t) = \sqrt{2t - 1}$.

   Determine the instantaneous velocity after 5 seconds.

4. Given $y = \sin^2(3x)$, Determine $\frac{d^2y}{dx^2}$.

5. Determine $\frac{dy}{dx}$ if $x \sin y = 1$.

6. Find $\frac{dy}{dx}$ for the parametric equations $x = 3t + 1$ and $y = 2t - 1$.

7. Find the equation of the normal line to $f(x) = e^{2x}$ at (0,1).

A. 26

B. $-\tan y / x$

C. $y = -2x + 1$ and $y = 4x - 4$

D. $y = 4x - 2$ and $y = -2x - 2$

E. $\frac{2}{3}$

F. $\frac{2}{\sqrt{11}}$ in/sec

G. $\frac{-5}{9}$ ft/sec

H. $\left(\frac{-1}{2}, -4\right)$

I. $\frac{27}{4}$

J. $6\cos 3x \sin 3x$

K. $\frac{\sin y}{x \cos x}$

L. $-1, -9$

M. $y = -2x - 1$ and $y = 4x - 4$

N. $y = \frac{-1}{2}x + 1$

8. A 13-foot ladder is leaning against the wall of a house. The base of the ladder slides away from the wall at a rate of 0.75 feet per second. How fast is the top of the ladder moving down the wall when the base is 12 feet from the wall?

9. Find the intervals on which $f(x) = \frac{x^2}{x^2 - 4}$ is increasing.

10 – 11.

10. Find the absolute maximum for f(x) = $x^3 - 4x^2 + 1$ on [–1, 5].

11. Find the absolute minimum for f(x) = $x^3 - 4x^2 + 1$ on [–1, 5].

12. Determine the slope of $9x - 4x\ln y = 3$ at $\left(\frac{1}{3}, 1\right)$.

13. Determine the points of inflection for the function f(x) = $4x^3 + 6x^2 - 5$.

14. Determine the y-intercept of the line passing through the point (– 5, 4) and perpendicular to the line 4x – 3y = 5.

15. Determine the interval over which the curve $y = \frac{x-1}{3+x}$ is concave down.

O. $(-3, \infty)$

P. $\frac{1}{4}$

Q. $\frac{-4}{9}$ ft/sec

R. 1

S. $(0,2)$ and $(2,\infty)$

T. $(-\infty,-2)$ and $(-2,0)$

U. $\frac{-229}{27}$

V. $\frac{1}{\sqrt{11}}$ in/sec

W. $18\cos 6x$

X. $9 - 4\ln 3$

Y. $(-1,-3)$

Z. $(-\infty,-3)$