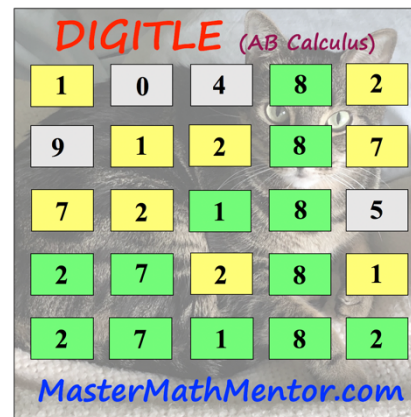


DIGITLE – AB CALCULUS

Puzzle 114 – Function Analysis



Directions: The first 5 problems have single digit answers. The 6th problem has a 5-digit answer (counting leading zeros if present). You have a choice: solve the easier single-digit answer problems or tackle the more difficult 5-digit answer. Once you have done that, attempt to solve the puzzle by entering the following url on your computer, tablet, or phone:

<https://mastermathmentor.com/mmm/digitle.ashx>.

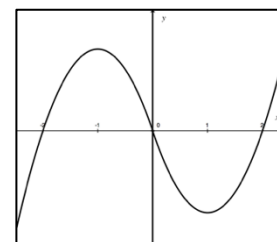
The correct puzzle answer will be the digits of your answer(s) scrambled. Use the following interpretation. You get 6 tries.

Green: the digit is in the answer and is in the correct spot.
Yellow: the digit is in the answer but is not in the correct spot.

Grey: the digit is not in the answer.

Single Digit Answers:

1) The graph of the twice-differentiable function f that is symmetric to the origin is shown in the figure to the right. How many of the following are positive?



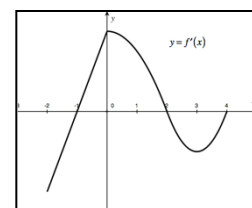
$$\begin{array}{lll} f(0)+f'(0) & f(0)+f''(0) & f'(0)\cdot f''(0) \\ f(-2)+f(2) & f'(-2)+f'(2) & f''(-2)\cdot f''(2) \\ f(-1)-f(1) & f'(-1)+f'(1) & -f''(-1)\cdot f''(1) \end{array}$$

2) A state website states that the number of new COVID cases is decreasing but not as fast as it was last week. If C represents the number of new COVID cases at the time of the report, what statement number represents the signs of C , $\frac{dC}{dt}$ and $\frac{d^2C}{dt^2}$?

Statement	0	1	2	3	4	5	6	7	8	9
C	0	0	+	-	+	-	+	-	+	-
$\frac{dC}{dt}$	+	0	+	+	+	+	-	-	-	-
$\frac{d^2C}{dt^2}$	+	-	+	+	-	-	+	+	-	-

3) Suppose $f'(x) = (x+4)(x+3)(x+2)(x+1)^2 x(x-1)(x-2)(x-3)^2(x-4)^2(x-5)$. If x_1, x_2, x_3, \dots represent the x -values where f has relative minima, find $|x_1 + x_2 + x_3 + \dots|$.

4) The graph of $y = f'(x)$ is shown on the figure to the right. There are a series of statements below. Assign 2 points for each statement that is correct and deduct one point for each statement that is incorrect. What is the absolute value of the point total?



- | | |
|--|---|
| i. f has a relative minimum at $x = -1$ | v. f is differentiable at $x = 0$ |
| ii. f has a point of inflection at $x = 2$ | vi. f is concave down on $(2, 3)$ |
| iii. f is increasing on $(-1, 2)$ | vii. f must be quadratic on $(-2, 0)$ |
| iv. f has a local maximum at $x = 0$ | |

5) If $f'(x) = (-4x+6)e^{-2x^2+6x+4.5}$, find the smallest x -value where $f(x)$ has an inflection point.

5-Digit Answer:

6) If $f(x) = \frac{x(x-24)^3 + 10}{2}$, find the vertical distance between its inflection points.