

# DIGITLE – AB CALCULUS

## Puzzle 110 – Continuity/Differentiability



**Directions:** The first 5 problems have single digit answers. The 6<sup>th</sup> 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.

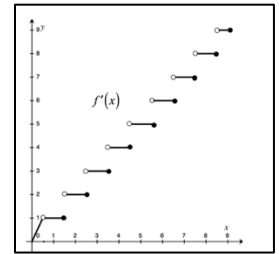
**Green :** the digit is in the answer and is in the correct spot.  
**Yellow:** the digit is in the answer but is not in the correct spot.

**Grey :** the digit is not in the answer.

### Single Digit Answers:

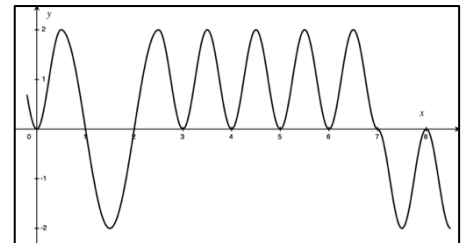
1) If  $f(x) = \begin{cases} \sqrt{x+1} + e^3, & x < 0 \\ e^{\sqrt{x+a+2}} + 1, & x \geq 0 \end{cases}$ , where  $a$  is a constant, find the value of  $a$  if  $f$  is continuous.

2) The graph of  $f'(x)$  is shown to the right. For how many integer values of  $x$  is the function  $f$  non-differentiable?



3) If  $f(x) = \begin{cases} ax^3 - 4x^2 + 4, & x < 2 \\ b(x+1)^2 - 4x - 6, & x \geq 2 \end{cases}$ , there are values of  $a$  and  $b$  that makes  $f$  differentiable. Find  $b$ .

4) The differentiable curve  $f(x)$  is shown on the figure on the right with roots at integers: 0, 1, 2, ... 8. At how many locations does the graph of  $|f(x)|$  fail to be differentiable?



5) If  $f(x) = \begin{cases} b \sin 2x - a^2 \cos x + 1, & x \leq 0 \\ ax + b \ln(x+1), & x > 0 \end{cases}$  where  $a$  and  $b$  are non-zero constants, is a differentiable function, find the value of  $a - b$ .

### 5-Digit Answer:

6) If  $f(x) = \begin{cases} 80 - x, & x < 1 \\ ax^2 + bx, & x \geq 1 \end{cases}$ , find the value of  $|ab|$  if  $f$  is differentiable.