# DIGITLE – AB CALCULUS
Puzzle 111 – Related Rates

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.
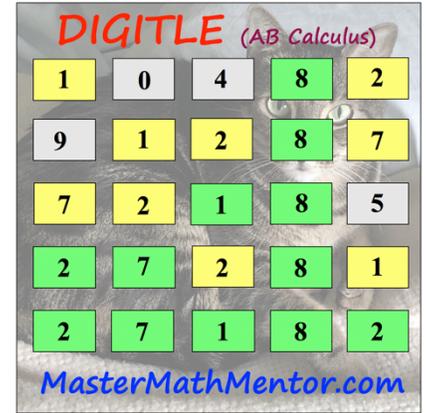
| Green : | the digit is in the answer and is in the correct spot. | Grey : | the digit is not in the answer. |

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

Single Digit Answers:

1) Andrew is climbing up the 1,576 steps of the Empire State Building. His speed in steps per minute is given by $S(s) = \dfrac{(1600 - s)^2}{10000}$ where s represents the number of steps he has climbed. When he is 176 steps from the top, climbing at the rate of 75 steps/minute, how fast is his speed changing in $\text{steps}/\text{min}^2$?

2) A heavy sofa, 10 ft. in length, is on casters and being moved around a corner as shown in the figure to the right. The ends of the sofa are always in contact with the walls. If the sofa is being pushed at the rate of 3 inches per second down the left-hand wall, how fast is the sofa moving along the bottom wall in inches per second at the moment when the sofa is 8 feet from the bottom corner?
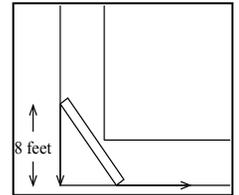
3) A particle is moving along the curve whose equation is $\dfrac{x + y^3}{1 + x^2} = -3$. If the y-coordinate increases at the rate of $17/27$ units/sec, how fast does the x-coordinate change when the particle is at the point $(-3, -3)$?

4) A circle with radius r is inside a square with side s as shown in the figure to the right. The lengths s and r are changing in a way such that the area of the shaded region is not changing. What is the rate of change of s with respect to r when the ratio of r to s is $1/\pi$?
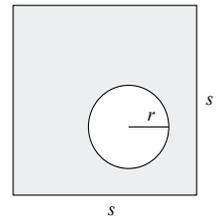
5) Water in a cylindrical rain barrel is evaporating due to lack of rain. The barrel has a 1.5-foot radius and water evaporates at the rate of $\dfrac{9}{28\pi} \dfrac{\text{ft}^3}{\text{day}}$. How long does it take for the water to reduce from 5 feet to 4 feet high?

5-Digit Answer:

6) A prison yard is 1,500 feet square. In the center, there is a searchlight that rotates at the rate of 3 revolutions per minute as shown in the figure to the right. What is the difference between the speed of the light at point P and point Q in ft/min?