

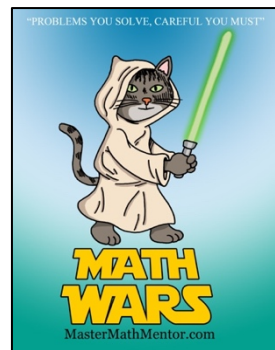
# Math Wars – AB Calculus

## Topic 112 – Related Rates



Maximum Time: 8.75 Minutes

**Directions:** To start, you need to download the Math Wars application on your cell phone: Use the QR code or the url: <https://mastermathmentor.com/mmm/mathwars.ashx?key=112>



When ready, start the timer and then solve the problems below, entering your choice, A, B, C, D and pressing **Submit** for each problem when you are sure of your answer. When complete, stop the timer. You will see problems you got correct in green and incorrect in red. You will receive a score based on how many problems you got right and your time. A perfect score is all problems correct using half the maximum time or less. You can text or email your friends with your results.

1. (1 pt) The current amount of water  $H$  in Lake Mead is decreasing at a faster rate than it was previously. Which statement is true?

A.  $\frac{dH}{dt} > 0, \frac{d^2H}{dt^2} > 0$       B.  $\frac{dH}{dt} > 0, \frac{d^2H}{dt^2} < 0$       C.  $\frac{dH}{dt} < 0, \frac{d^2H}{dt^2} > 0$       D.  $\frac{dH}{dt} < 0, \frac{d^2H}{dt^2} < 0$

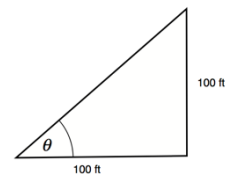
2. (3 pts) A cylindrical mold of rubber is 5 inches high with a diameter of 10 inches. It is placed under a hydraulic press. Since it is rubber, it compresses and while the radius does not change, the volume decreases by  $80 \text{ in}^3/\text{sec}$ . Which is closest to how fast the height of the mold decreases during the time it compresses?

A.  $0.2 \text{ in}^3/\text{sec}$       B.  $1 \text{ in}^3/\text{sec}$       C.  $\pi \text{ in}^3/\text{sec}$       D.  $5 \text{ in}^3/\text{sec}$

3. (5 pts) Sand falls from an overhead bin, creating a conical pile whose diameter is always 4 times its height. If the sand falls at a rate of  $72 \text{ ft}^3/\text{min}$ , how fast is the height of the pile increasing when the pile is 3 feet high?

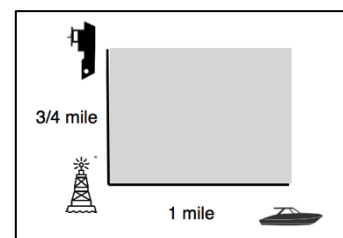
A.  $\frac{1}{\pi} \text{ ft/sec}$       B.  $\frac{1}{2\pi} \text{ ft/sec}$       C.  $\frac{2}{\pi} \text{ ft/sec}$       D.  $2\pi \text{ ft/sec}$

4. (7 pts) An apartment building whose height changes by 2 ft per day is being built. A laser surveying tool is fixed 100 ft from the base of the building as shown in the figure and it keeps the current top of the building always in focus. When the building is 100 ft high, approximately how fast does the angle of elevation of the surveying tool change?



A.  $0.005^\circ/\text{day}$       B.  $0.01^\circ/\text{day}$       C.  $0.02^\circ/\text{day}$       D.  $0.6^\circ/\text{day}$

5. (9 pts) A coast guard cutter is monitoring traffic as shown in the figure to the right. A speedboat passes a buoy going 10 mph. Using binoculars, the coast guard checks the boat's registration and realizes it was stolen. The coastguard follows the speedboat at 20 mph but cannot go into the area shown in grey because the water is too shallow. How fast is the distance between the coastguard and speedboat changing when the coastguard is  $\frac{3}{4}$  mile from the buoy and the speedboat is 1 mile from the buoy?



A. decreasing at 4 mph      B. decreasing at 10 mph      C. decreasing at 10 mph      D. not changing