Bronx High School of Science
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Mathematics Department
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MA2 Exam 1 Review Sheet

All problems must be answered using calculus techniques. Final answers must be *exact* (not rounded), *in simplest form*, and include appropriate *units* unless otherwise indicated. Leave all answers in terms of π, where appropriate. Put a box around your final answer. Graphing calculators, though not required, may be used on this exam, with the following exceptions: TI-89, TI-92, or any calculator with symbolic manipulation abilities.

1. The length of each side of a cube is increasing at the rate of ½ centimeter per second. At what rate is its volume increasing when the side is 10 centimeters long?

2. A computer screen saver contains a *square* which is expanding on the screen. The edge of the square is growing at a constant rate of 0.5 centimeters per second. How fast is the area inside the square growing when the edge is 8 cm long?

3. Air is being pumped into a spherical balloon at a rate of 100 cubic centimeters per second. How fast is the radius of the balloon increasing when its diameter is 50 centimeters?

4. A ladder 10 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 1 foot per second, how quickly is the top of the ladder moving when the base of ladder is 6 feet from the wall?

5. A water tank has the shape of an inverted cone whose height is always twice its radius. The tank is being filled with water at a rate of 2 cubic meters per minute. Find the rate at which the water level is rising when it is 3 meters deep.

6. A man is walking along a straight path at a speed of 4 feet per second. A searchlight is located on the ground 20 feet from the path and is kept focused on the man. At what rate is the searchlight rotating when the man is 15 feet from the point on the path closest to the searchlight?

7. A pile of sand is shaped like a right circular cone. It is shaped such that the base radius of the pile is one third of its height. Sand is being added to the pile at the steady rate of 10 cubic feet per minute. How fast is the height of the pile rising when the pile is 4 feet tall?

8. A car is heading east toward an intersection at the rate of 40 miles per hour. A truck is heading south, away from the same intersection, at the rate of 60 miles per hour. At what rate is the distance between the car and the truck changing when the car is 8 miles from the intersection and the truck is 15 miles from the intersection?

9. Suppose that $z = x^3 y^2$ where both x and y are changing over time. At a certain instant when $x = 1$ and $y = 2$, x is decreasing at the rate of 2 units per second and y is increasing at the rate of 3 units per second. How fast is z changing at this instant? Is z increasing or decreasing?