Calculus 1 Workbook

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■ 1. A boy is standing 15 feet from the base of a 100 feet cliff. As a boulder rolls off the cliff, the boy begins running away at 8 ft/s. At what rate is the distance between the boy and the boulder changing after 2 seconds?

The height of the falling boulder is modeled by the position function $s = -16t^2 + v_0 t + s_0$, where s_0 is the initial height and v_0 is the initial velocity of the boulder.

■ 2. Water is flowing out of a cone-shaped tank at a rate of 6 cubic inches per second. If the cone has a height of 5 inches and a base radius of 4 inches, how fast is the water level falling when the water is 3 inches deep?

■ 3. A ladder 25 feet long leans against a vertical wall of a building. If the bottom of the ladder is pulled away horizontally from the building at 3 feet per second, how fast is the angle formed by the ladder and the horizontal ground decreasing when the bottom of the ladder is 7 feet from the base of the wall?

■ 4. The radius of a spherical balloon is increasing at a rate of 4.5 ft/hr. At what rate are the sphere's surface area and volume increasing when the surface area is 36π ft^2?

■ 5. A price p and demand q for a product are related by $q^2 - 2qp + 30p^2 = 10{,}125$. If the price is increasing at a rate of 2.5 dollars per month when the price is 15 dollars, find the rate of change of the demand.

■ 6. A trough of water 15 meters long, 8 meters wide, and 10 meters high has ends shaped like isosceles triangles. If water is being pumped in at a constant rate of 6 m³/s, how fast are the height and width of the water changing when the water has a height of 250 cm?