HL1 TEST REVIEW (Test on 2-14 ??)

[1] A large balloon is rising vertically at 4ft/sec. An observer stands 500 feet from where the balloon was released.

[a] Draw a diagram and find *z*, the distance of the balloon from the observer when the balloon is 1200 ft in the air. Label the height of the balloon *y*.

[b] Write a formula relating *y*, *z*, and 500. Differentiate this formula with respect to time.

[c] Find the rate at which the distance between the balloon and the observer is increasing when the balloon is 1200 ft in the air.

[2] Before being launched, the spherical balloon in [1] was inflated at a rate of 100 ft^3/min.

[a] The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$. Find the rate at which the volume is increasing when the radius of the balloon is 5 ft.

[b] The surface area of a sphere is given by $A = 4\pi r^2$. Find the rate at which the surface area is increasing when the radius of the balloon is 5 ft.

[3] A rectangle is inscribed under the graph of $y = \sqrt{4 - x^2}$. Find the dimensions of the largest such rectangle.

[4] The largest rectangular box that a particular company will ship is allowed to have a girth of 64 inches. Label the dimensions of the box *x*, *x*, and *y*. The girth is $4x + y$. Find the value of *x* that yields the largest possible volume for the box.

[5] For each function, find the intervals on which it is increasing and the intervals on which it is concave up.

[a] $y = x^4 - 2x^2$ [b] $y = 2xe^x$ [c] $y = \frac{1}{x^2 + 1}$

[6] [a] Write a 3rd-degree polynomial to approximate $y = \sqrt{x+4}$ centered at $x = 0$.

[b] Write a 5th-degree polynomial to approximate $y = x^2\sqrt{x+4}$ centered at $x = 0$.

[7] Evaluate each limit.

[a] $\lim_{x\to\infty}\left(1 - \frac{3}{x}\right)^x$ [b] $\lim_{x\to 0}\frac{\sin x - x}{x^3}$