MA 16010 Quiz 5

Simplify your final answer. Show all relevant work for each problem. Little to no work, even with a correct answer, will receive little to no credit.

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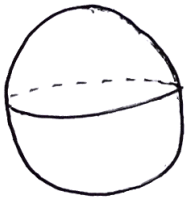
1. As a spherical snowball is melting its radius is decreasing at a rate of 5cm/hr. How fast is the surface area of the snowball decreasing when the radius is 8cm? Note that the surface area of a sphere is $A = 4\pi r^2$ where r is the radius of the sphere. (Be careful with negative signs. Keep your answers exact and give the units).



$A = 4\pi r^2 \qquad \frac{dr}{dt} = -5 \qquad r = 8 \qquad \frac{dA}{dt} = ?$

$\frac{dA}{dt} = 8\pi r \frac{dr}{dt}$

$\frac{dA}{dt} = 8\pi(8)(-5)$

$\Rightarrow \frac{dA}{dt} = -320\pi \text{ cm}^2/\text{hr}$

The surface area is decreasing at 320π cm^2/hr.

2. Consider the function $f(x) = 4x^3 + 4x^2 + 1$.
   a. Find the critical numbers for f.
   b. Find the intervals on which f is increasing and the intervals on which it is decreasing.
   c. Find any relative extrema (max/min) for f (only give the x-coordinate of relative extrema, you don't have to find the y-coordinate).

$f'(x) = 12x^2 + 8x$

$= 4x(3x+2)$

$4x(3x+2) = 0$

$x = 0 \quad x = -2/3$

Critical numbers

$f'(x)$ + 0 − − 0 + +

$-2/3$ max, 0 min

Inc: $(-\infty, -2/3)$, $(0, \infty)$

Dec: $(-2/3, 0)$

Relative min at $x = 0$

Relative max at $x = -2/3$