

§12.5: THE CHAIN RULE

1. Suppose that the portion of a tree that is usable for lumber is a right circular cylinder. If the usable height of a tree increases 2 ft per year and the usable diameter of a tree increases 3 in per year, how fast is the volume of usable lumber increasing when the usable height of the tree is 20 ft and the usable diameter is 30 in?

2. Two straight roads intersect at right angles. Car A , moving on one of the two roads, approaches the intersection at 25 mi/h and car B , moving on the other road, approaches the intersection at 30 mi/h. At what rate is the distance between the cars (as the crow flies) changing when A is 0.3 mile from the intersection and B is 0.4 mile from the intersection?

§12.6: DIRECTIONAL DERIVATIVES AND GRADIENTS

3. Suppose that $D_{\vec{u}}f(1, 2) = -5$ and $D_{\vec{v}}f(1, 2) = 10$, where $\vec{u} = \langle \frac{3}{5}, -\frac{4}{5} \rangle$ and $\vec{v} = \langle \frac{4}{5}, \frac{3}{5} \rangle$. Find
 - (a) $f_x(1, 2)$
 - (b) $f_y(1, 2)$
 - (c) the directional derivative of f at $(1, 2)$ in the direction of the origin.