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A conical tank (with its tip down and the circular base parallel to
and above the ground) is filling with water in such a way that the
height of the water is increasing at a rate of 0.1cm/hr at the instant
that the height of the water level is 10cm.  If the tank has a radius
of 12cm and a height of 30cm, find how fast the area corresponding to
the top of the water level is increasing at this instant.
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Solution.

1.It is given that the radius of the base of the tank $R = 12cm$,and the height of the tank $H = 30cm$. Denote as $h(t)$ the level of the water at the moment *t* and *r(t)*-the radius of corresponding water surface. At the instant t_0 the values $h(t_0) = 10cm$ and $\dot{h}(t_0) = 0.1cm/hr$.

2.Considering the vertical cross section of the tank one may write

$$\frac{h(t)}{r(t)} = \frac{H}{R} .$$

Hence $r(t) = \frac{R}{H} h(t)$ and the area of the water surface

$$S(t) = \pi r^2(t) = \frac{\pi R^2}{H^2} h^2(t) .$$

Differentiating this expression we have

$$\dot{S}(t) = \frac{2\pi R^2}{H^2} h(t) \dot{h}(t) ,$$

Or at the moment $t = t_0$

$$\dot{S}(t_0) = \frac{2\pi * 12^2}{30^2} * 10 * 0.1 cm^2 / hr = \frac{72\pi}{225} cm^2 / hr .$$

Answer: $\frac{72\pi}{225} cm^2 / hr$