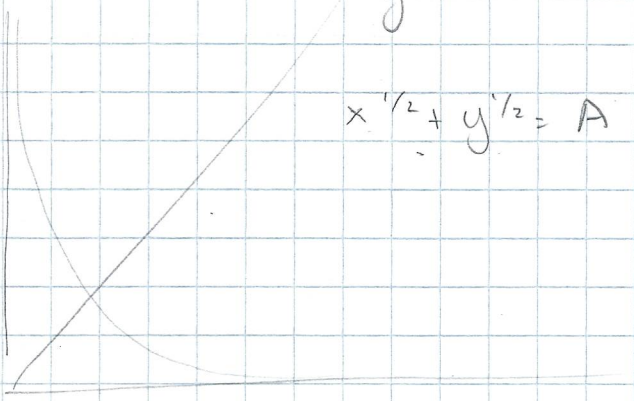
20-P-WE-AF-017

Conservative Forces: Advanced

Q: The skate boarder reaches point A with a speed of v = vel m/s. Determine the normal acceleration at point B. Neglect friction and size of the boarder.

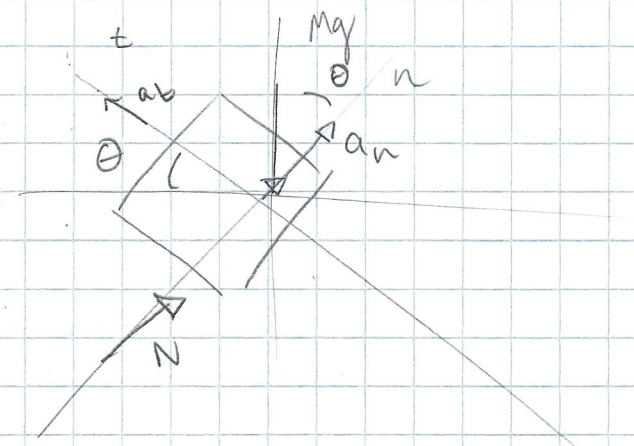
A:



$y = x$

$x^{1/2} + y^{1/2} = A$

$x = \frac{A^2}{4}$



$V_{gA} = 0$

$V_{gB} = mgh_B = M \cdot 9.8 \cdot \left(\frac{A^2}{4}\right)$

$T_A + V_A = T_B + V_B$

$\frac{1}{2} M (V)^2 + 0 = \frac{1}{2} M v_B^2 + Mg\left(\frac{A^2}{4}\right)$

$\sqrt{2\left[\frac{1}{2}(V)^2 - g\left(\frac{A^2}{4}\right)\right]} = V_B$

$y = (A - x^{1/2})^2$

$dy/dx = \frac{\sqrt{x} - A}{\sqrt{x}}$

$d^2y/dx^2 = \frac{1}{2}x = \frac{\sqrt{x} - 0}{2x^{3/2}}$

$w/x = \frac{A^2}{4}$

$\rho = \frac{\left[1 + (dy/dx)^2\right]^{3/2}}{|d^2y/dx^2|}$

$a_n = \frac{v_B^2}{\rho}$

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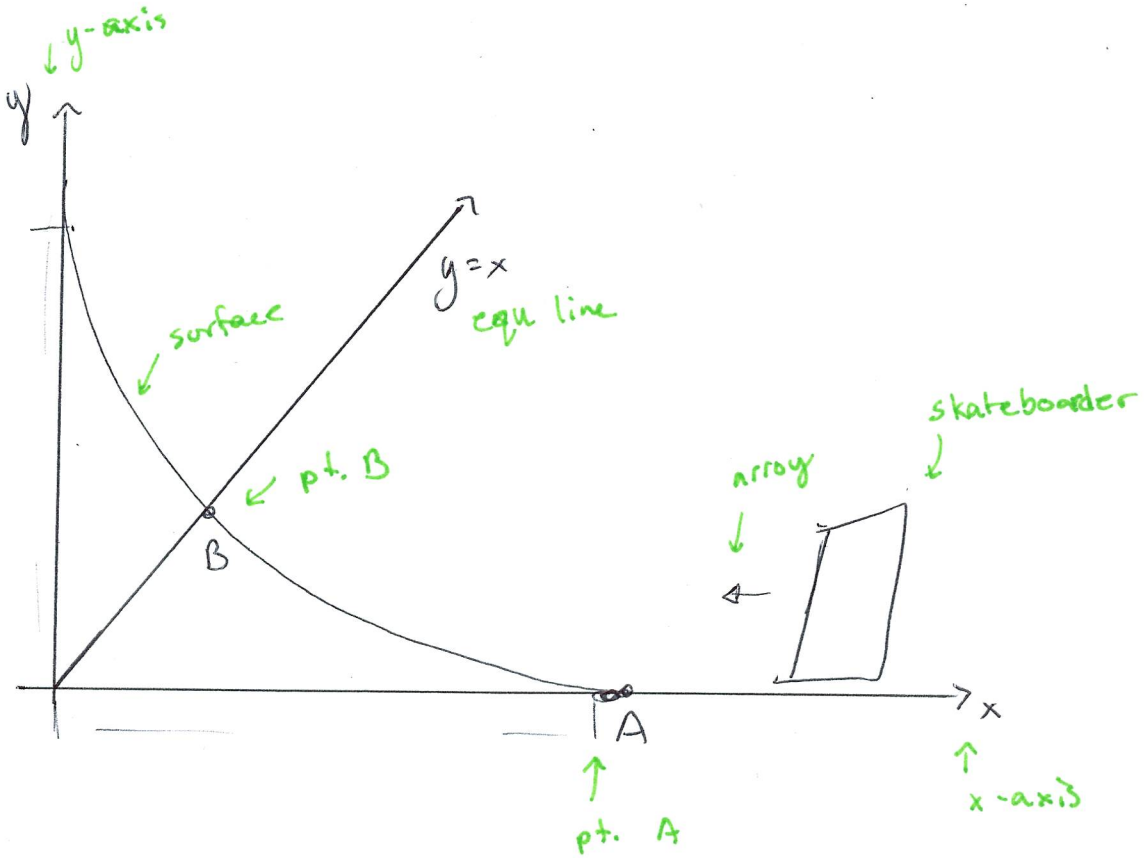
y-axis
y
y=x
equ line
surface
pt. B
B
skateboarder
arrow
A
x
pt. A
x-axis