A piano string stretches 4 mm when a force of 150 N is applied. How much will it stretch if the force is increased to 900 N?

24 mm

Use Hooke's Law: F = kx, where k is a constant.

$(F/x)_{initial} = (F/x)_{final}$, because F/x is equal to the constant, k

(150 N / 4 mm) = (900 N / X mm)

X = (900 N * 4 mm) / 150 N

6. A certain star, of mass m and radius r, is rotating with a rotational velocity ω. After the star collapses, it has the same mass but with a much smaller radius. Which statement below is true?

a. The star's moment of inertia I has decreased, and its angular momentum L has increased.
b. The star's moment of inertia I has decreased, and its angular velocity ω has decreased.
c. The star's moment of inertia I remains constant, and its angular momentum L has increased.
d. The star's angular momentum L remains constant, and its rotational kinetic energy has decreased.
e. The star's angular momentum L remains constant, and its rotational kinetic energy has increased.

Use I of a solid sphere: $2/5\ mr^2$.

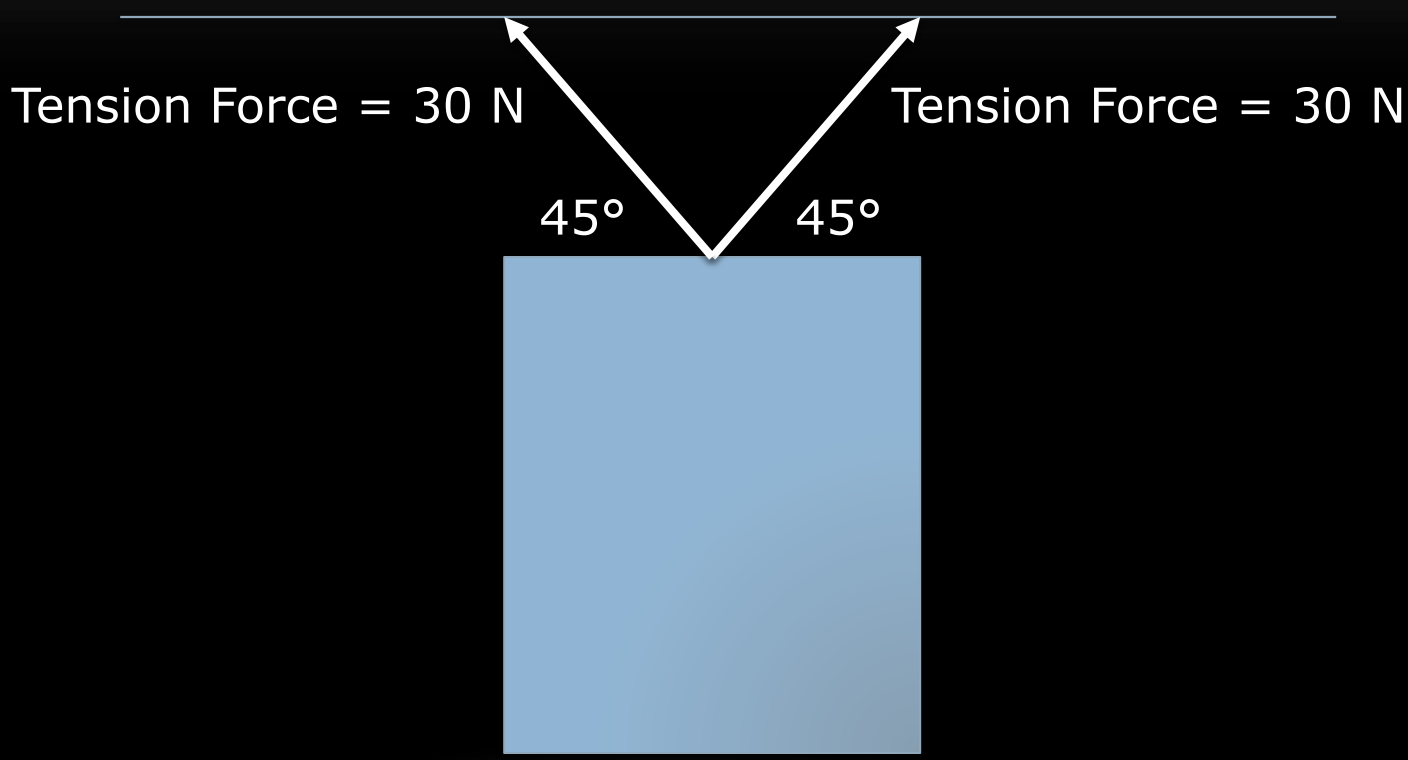
Conservation of angular momentum, L, always holds in an isolated system (no external torque applied). Thus answers a and c are wrong.

If m stays the same, as r decreases the moment of inertia, I, decreases. Since L is constant and L = Iw, if I is decreasing then w must increase. Thus answer b is wrong.

Rotational KE is $\frac{1}{2} I w^2$. You can rewrite this as KE = ½ L w, where L is Iw, or angular momentum. L stays the same but w increases, so KE will also increase.

The answer is e.

A picture hangs on the wall, as shown in the illustration. What is the mass of the picture?



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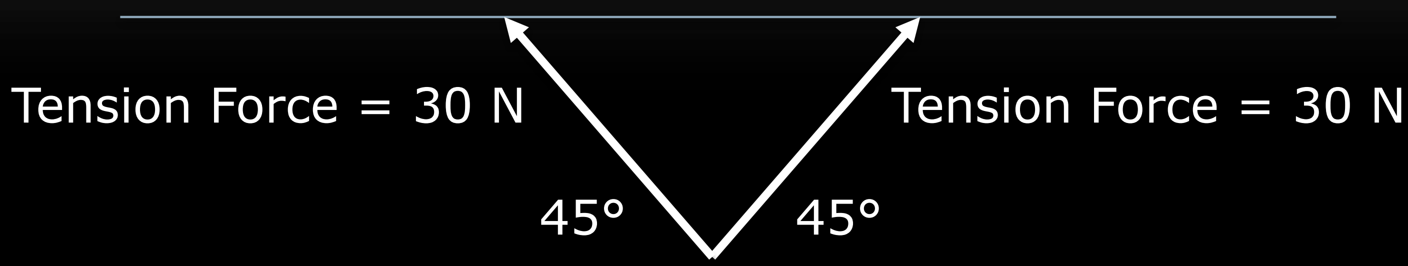

This is an equilibrium problem, so the sum of the forces in each direction has to equal 0. You have to decompose the total Tension Force into x and y components, using trig.

In the y direction, each of the T forces points up. You also have the F gravity pointing down. Since the Tension and angle are the same on each side, you can write:
Sum $F_y = 0 = 2 * (30N * \sin 45) - (m * 9.8\ m/s^2)$

$2 * (30N * \sin 45) = (m * 9.8\ m/s^2)$

or, m = 4.32 kg