

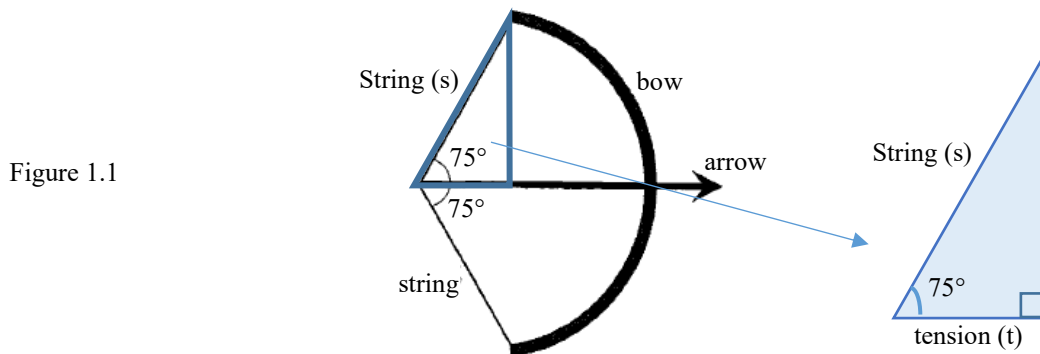
S2 Mathematics
Cross Topics – Trigonometric Ratio & Method of Substitution

Name : _____

Class : _____ ()

Date: _____

1. A bow and arrow is a kind of projectile weapon. The string of a bow is drawn taut by a hunter with a force of 60 N and an arrow of mass 0.2 kg is held stationary as shown in Figure 1.1.



- (a) (i) Find the tension of the string.

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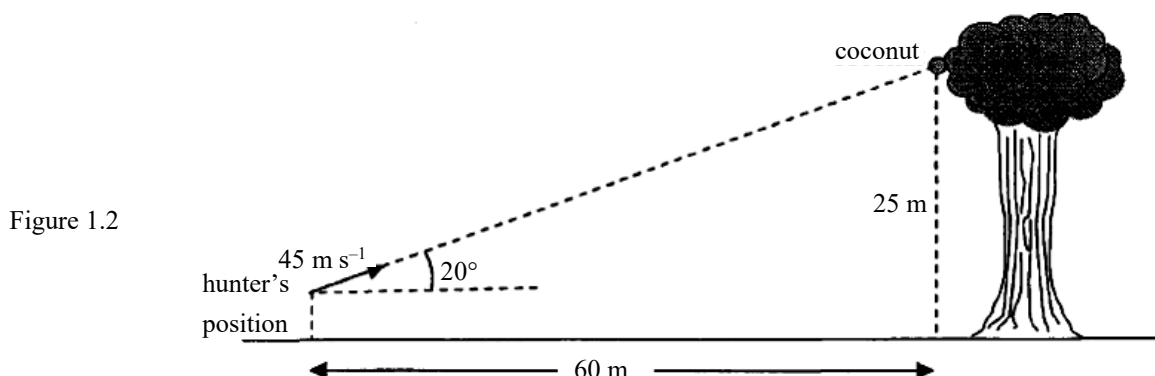
- (ii) It is given that $E = \frac{1}{2}mv^2$. Estimate the energy stored in the taut string if the initial speed of the arrow is 45 ms^{-1} when released.

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*(b) The hunter stands at about 60 m away from a tree as shown in Figure 1.2. He uses the bow to release the arrow in order to shoot a coconut held by a monkey (not shown in the figure) in the tree. The coconut is at a height of 25 m from the ground. The hunter aims directly at the coconut and the arrow leaves the bow at a speed of 45 ms^{-1} making an angle of 20° to the horizontal. At the moment the hunter releases the arrow, the monkey drops the coconut such that it falls vertically from rest. Neglect air resistance and the arrow's size. ($g = 9.81 \text{ m s}^{-2}$)



- (i) Find the time taken for the arrow to hit the coconut.

- (ii) Find the height of the coconut from the ground at the moment the arrow hits it, provided that $h = 25 - \frac{1}{2}gt^2$.

Marking scheme

	Solutions
(a)(i)	Let T be the tension. $2T\cos 75^\circ = 60$ $T = 116 \text{ N}$
(a)(ii)	Energy stored in the string $= \frac{1}{2}(0.2)(45)^2$ $= 202.5 \text{ J}$
(b)(i)	$d = \cos 20^\circ t$ $60 = 45\cos 20^\circ t$ $t = 1.42 \text{ s}$
(b)(ii)	$h = 25 - \frac{1}{2}gt^2$ $h = 25 - \frac{1}{2}(9.81)(1.42)^2$ $h = 15.1 \text{ m [or } h = 14.9 \text{ m]}$