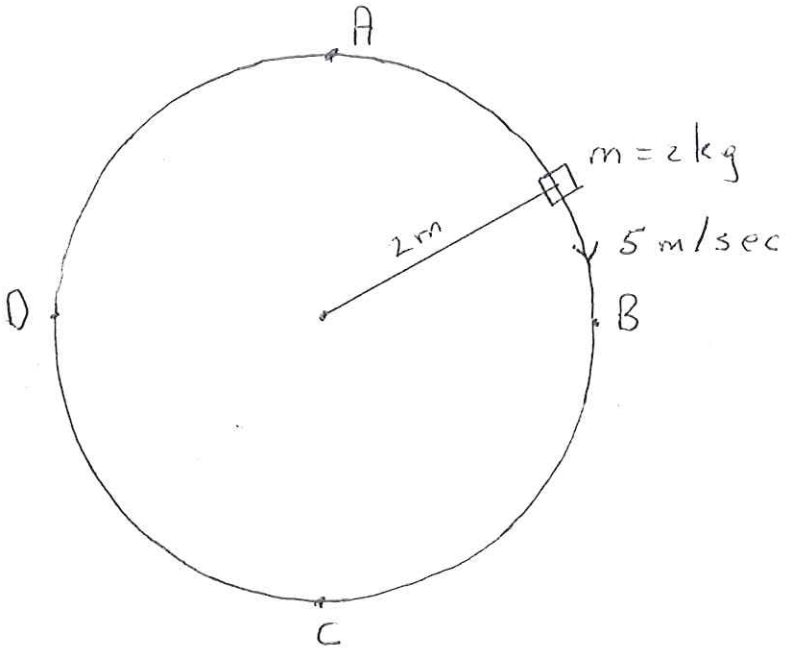
Quiz 3

Name: _____ Student Number: _____

CALCULATORS ALLOWED.

10 MARKS

1. (4 marks) Consider a 2 kg object held at the end of a string of length 2 meters that is in swung in a circle as shown below with a speed of 5 m/sec. What is the tension in the string at points A, B, C and D? Remember tension is a vector.



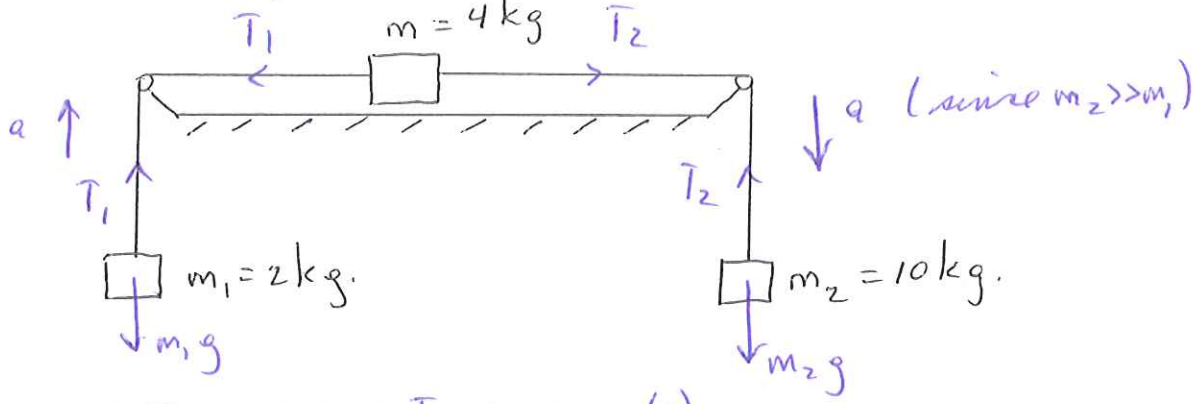
$\frac{mv^2}{r} = \frac{2\,kg\,(5\,m/sec)^2}{2\,m} = 25\,Nt$, $mg = 20\,Nt.$

at A: String tension $T = \frac{mv^2}{r} - mg = 5\,Nt.$ (down)

at B: $T = \frac{mv^2}{r} = 25Nt$ (toward circle center)
& D

at C: $T = \frac{mv^2}{r} + mg = 45Nt.$ (up)

2. (6 marks) Consider mass m on a table attached two masses m_1 and m_2 as shown. The coefficient of friction of mass m on the table is 0.1. Find the acceleration and the tensions in the two strings.



Mass m_1: $m_1 a = T_1 - m_1 g$ (1)

Mass m_2: $m a = T_2 - T_1 - \mu m g$ (2)

Mass m_3: $m_2 a = m_2 g - T_2$ (3)

$(1) + (2) + (3) \Rightarrow (m_1 + m + m_2) a = (m_2 - m_1 - \mu m) g$

$$a = \frac{(m_2 - m_1 - \mu m)}{(m_1 + m + m_2)} g$$

$$= \frac{10 - 2 - 0.1 \times 4}{10 + 4 + 2} \times 10$$

$$= 4.75 \text{ m/sec}^2$$

Subst. a into (1) $\Rightarrow$ $T_1 = m_1 (a + g)$

$= 2(10 + 4.75)$

$= 29.5$ Nt.

Subst. a into (3) $\Rightarrow$ $T_2 = m_2 (g - a)$

$= 10(10 - 4.75)$

$= 52.5$ Nt