Welcome!

4pm – 5pm (THU / SUN OFF)

$\begin{bmatrix} \text{JAN} \\ \text{M1} \end{bmatrix} \begin{bmatrix} \text{FEB} & \text{MARCH} \\ \text{P1} & \text{P1} \end{bmatrix}$

LGS (A1) → School (P1/P3)		Feb	March
	4–5pm (AS)	P1	P1
	5–6pm (A2)	P3	P3

M1 contains diff and integration of P1 only.

$\boxed{\text{M1}}$ $\boxed{\text{P4}}$ (50 Marks) (1h 15m) (7 to 8 Questions)

(VERY EASY PAPER EVEN FOR NON-SCIENCE PPL.)

HIGH PERCENTILE : 42 – 46 out of 50.

(TOTAL 12 WORKINGS)

FORCES

PUSH/PULL ⟶ FORCE → UNITS (NEWTON)

SPECIAL FORCE : **WEIGHT**

~~75kg~~ → Mass

Pull of gravity on an object.

$W = 75(10)$

$W = 750N$

$$\boxed{W = mg}$$

Mass in(kg) $g = 10$.

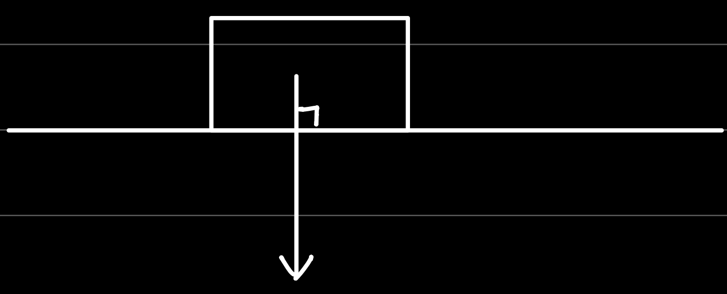
g = acceleration due to gravity = 10 N/kg

10 m/s²

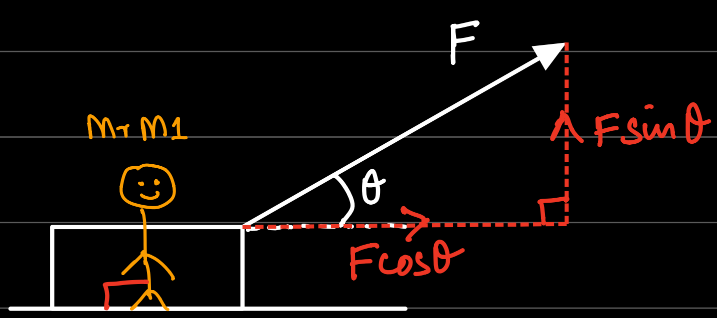
(In whole M1, $g = 10$) (In Physics $g = 9.81$)

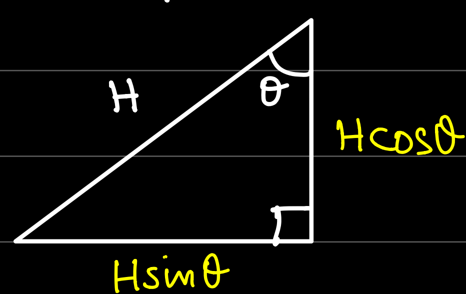
DIRECTION : TOWARDS GROUND MAKING 90° WITH GROUND (HORIZONTAL).

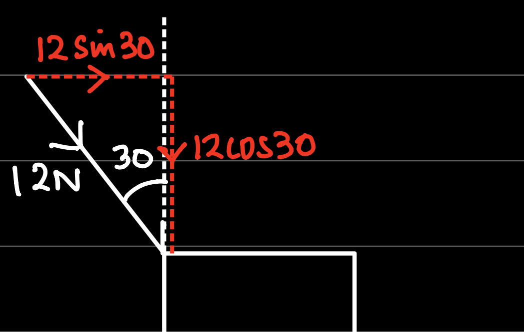
Line of weight starts from centre of object.

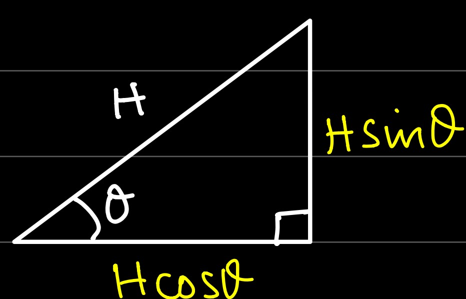


COMPONENTS OF A FORCE :-

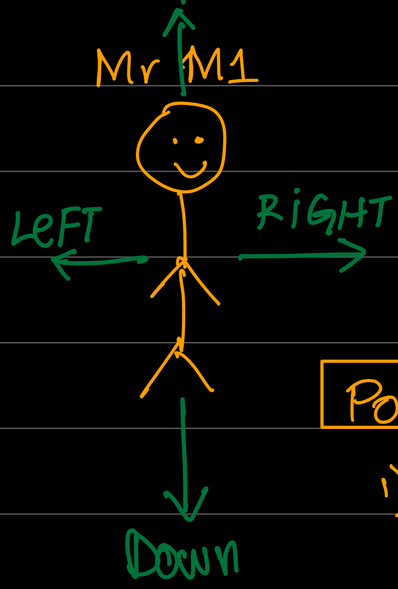








UP



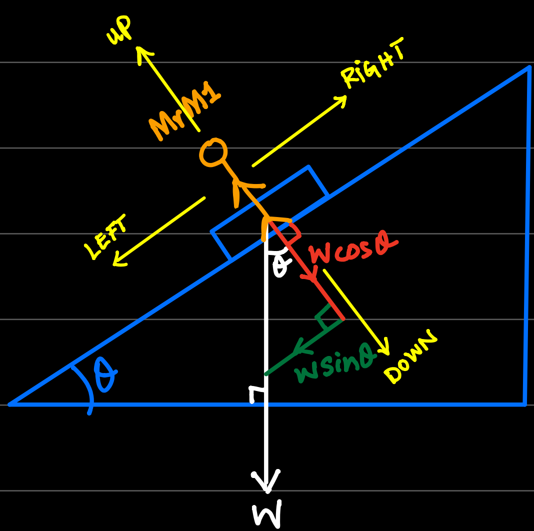
Can only understand Forces which are UP/DOWN/LEFT/RIGHT.

POSITION OF M1

1) STANDS ON POINT OF CONTACT BETWEEN OBJECT & SURFACE.
2) ALWAYS STANDS SUCH THAT HE MAKES 90° TO SURFACE.

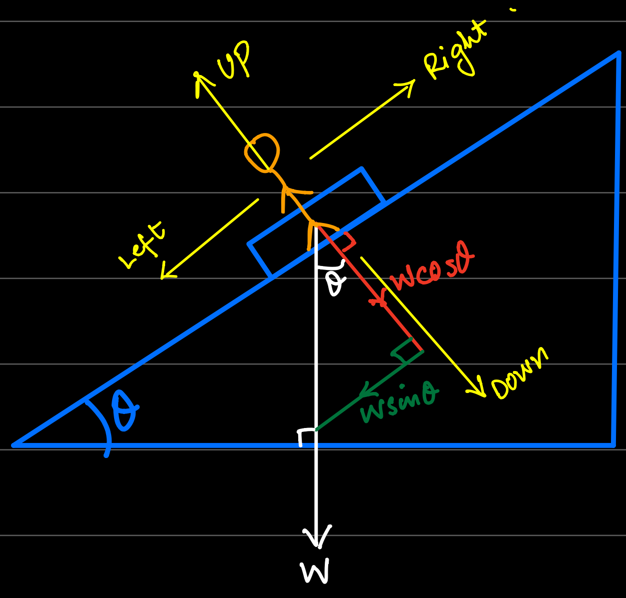
IN COMPLETE M1 THE WORDS UP/DOWN/LEFT/RIGHT ARE USED FROM MR M1's PERSPECTIVE.

INCLINED PLANES:

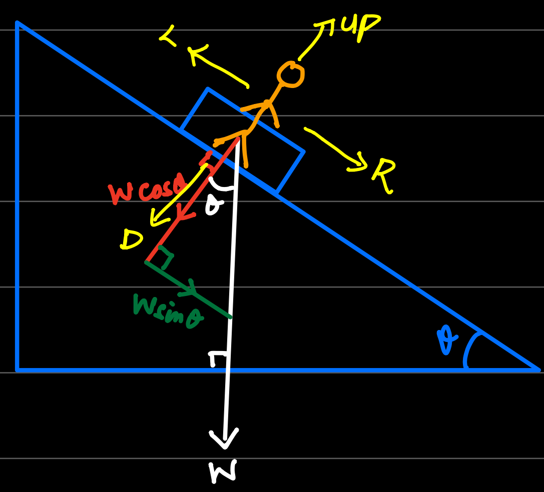


THREE LINES.

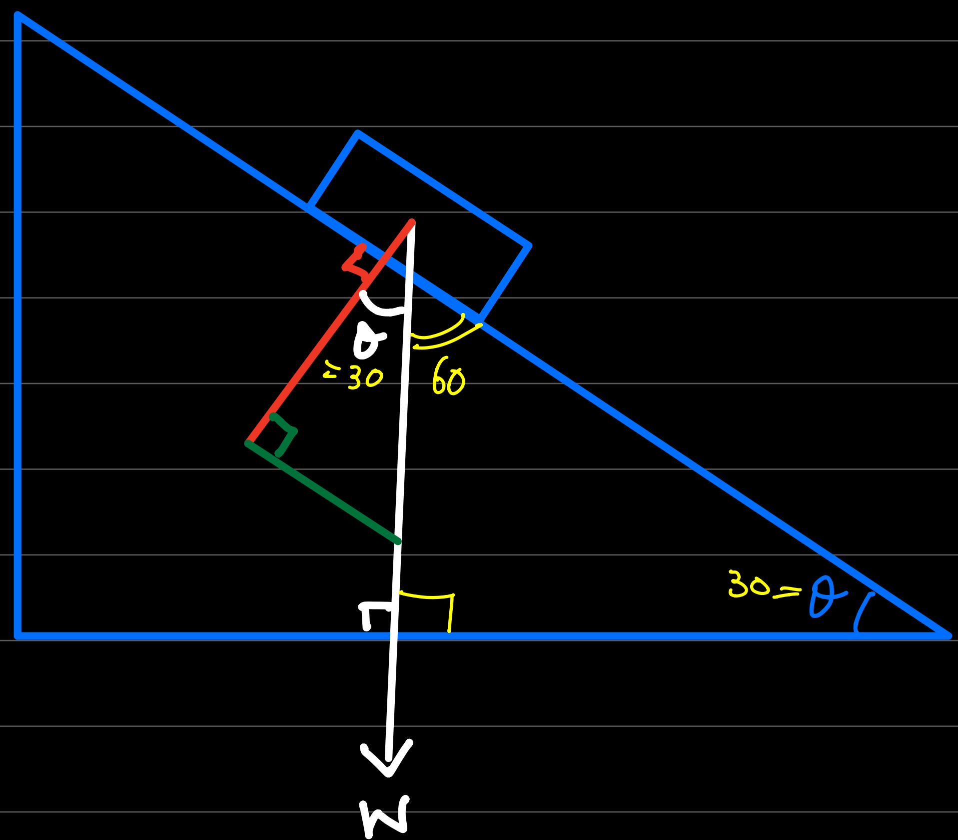
1) Weight (90° to ground)
2) 90° TO PLANE
3) PARALLEL TO PLANE.



Up
Right
Left
Wcosθ
θ
Wsinθ
Down
θ
W



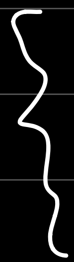
L
up
R
Wcosθ
θ
D
Wsinθ
θ
W



θ
=30
60
30=θ
W

TENSION

FORCE APPLIED BY THE ROPE/STRING ON AN OBJECT.



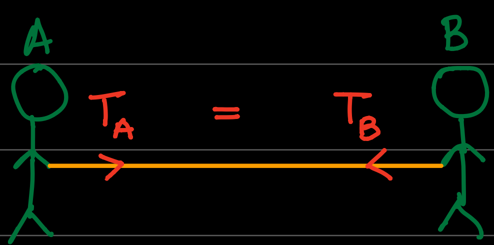
Slack
(No Tension)

Taut
(There is tension)

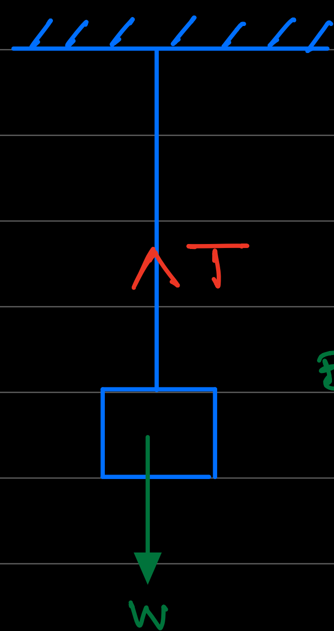
DIRECTION OF TENSION:

ACTS AWAY FROM POINT OF OBSERVATION

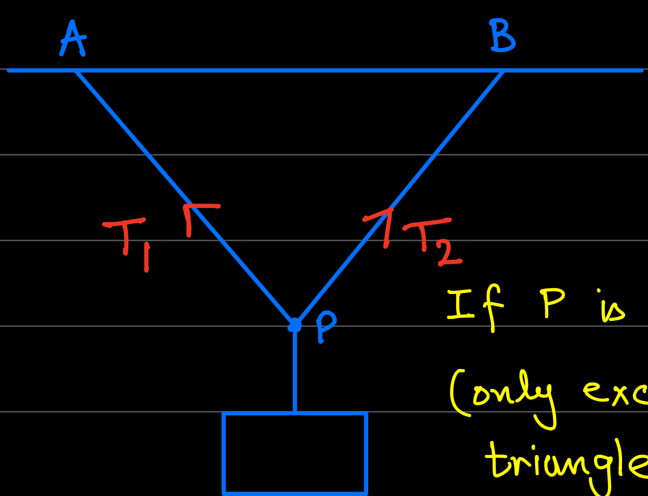
POINT OF OBSERVATION IS MENTIONED IN QUESTION.



Rope is Taut.



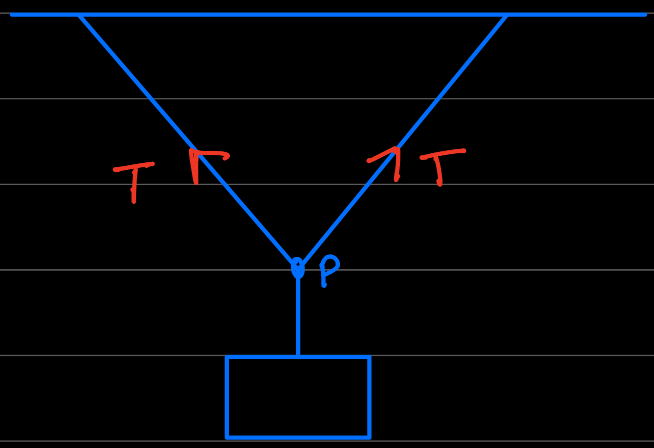
Box is AT REST.



P is a fixed point.

P is point of observation.

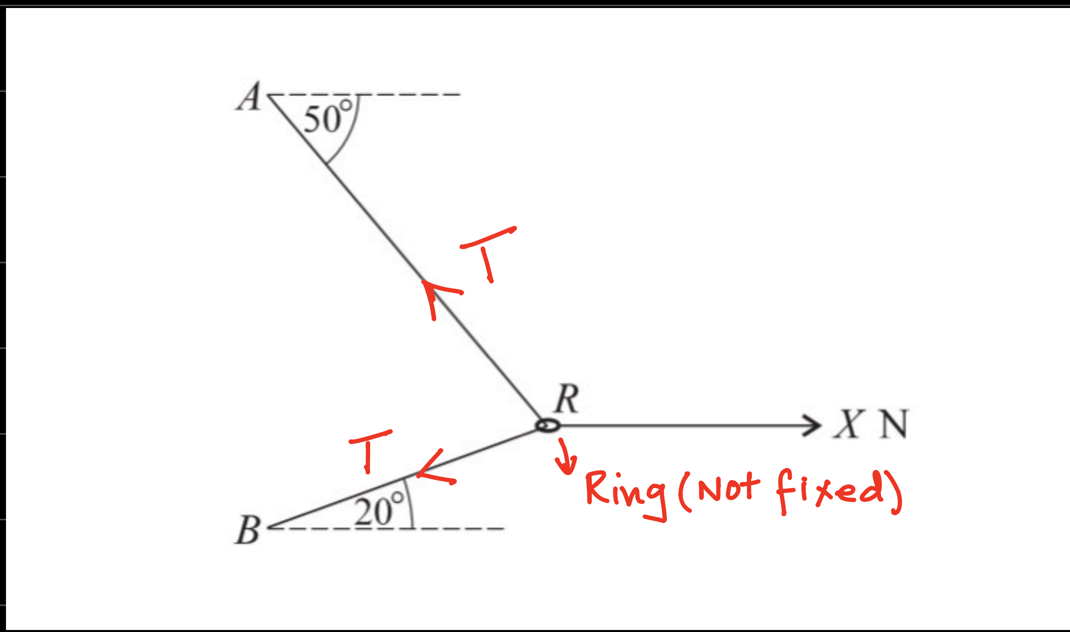
If P is fixed T_1 and T_2 are different (only exception is if there is an isosceles triangle. In that case only $T_1 = T_2$).



P is a smooth ring.
String is threaded through the ring.
(Ring can slip).

P = point of observation.

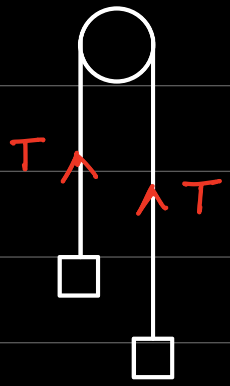
IF POINT P can slip, BOTH TENSIONS ARE ALWAYS SAME REGARDLESS OF SHAPE OF DIAGRAM.

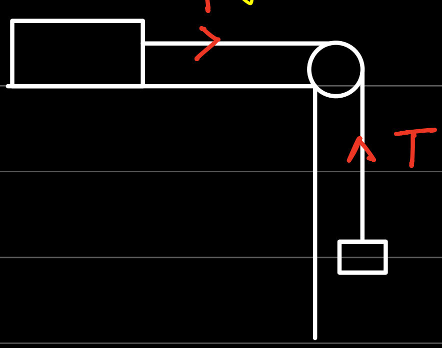


PULLEYS / PEG :-

IN ANY SHAPE, TENSION IN A PULLEY SYSTEM IS SAME AND ACTS TOWARDS THE PULLEY.

Even if weights are different, objects are at rest or are moving.





Objects are points of observation here.

WORKING # 1 EQUILIBRIUM

(BALANCED) (STATIONARY) (REST)

UP = down Left = Right.

(UP, DOWN, LEFT, RIGHT is FROM Mr M1's PERSPECTIVE)

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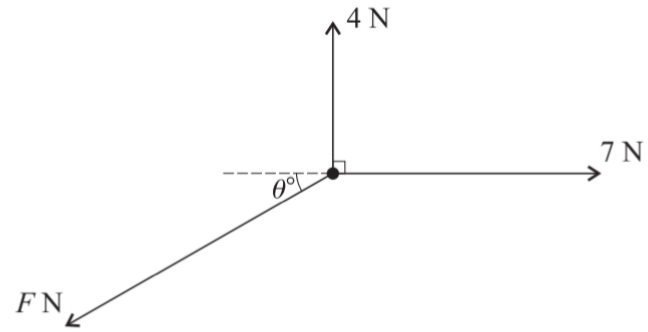
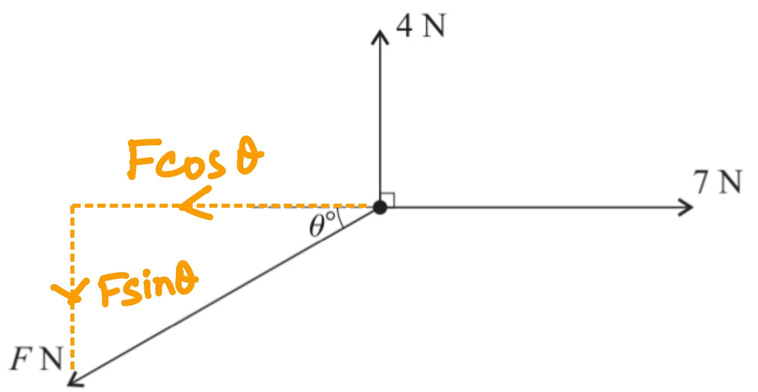


A particle is in equilibrium on a smooth horizontal table when acted on by the three horizontal forces shown in the diagram.

→ NO FRICTION.

(i) Find the values of F and θ. [4]



up = down

$4 = F\sin\theta$

$\boxed{F\sin\theta = 4}$

Left = Right.

$\boxed{F\cos\theta = 7}$

THIS TYPE OF SIMULTANEOUS IS SPECIAL.

$\left\{\begin{array}{l} F\sin\theta = \square \\ F\cos\theta = \square \end{array}\right\}$ THIS WORKING COMES IN P3 AND M1

STEP1

$$\frac{\cancel{F}\sin\theta}{\cancel{F}\cos\theta} = \frac{4}{7}$$

$$\tan\theta = \frac{4}{}$$

STEP2 SQUARE BOTH EQUATIONS AND ADD.

$$F^2\sin^2\theta = 16$$

$$+\ F^2\cos^2\theta = 49$$

$$F^2\sin^2\theta + F^2\cos^2\theta = 16 + 49$$

7

$\theta = \tan^{-1}\left(\frac{4}{7}\right)$

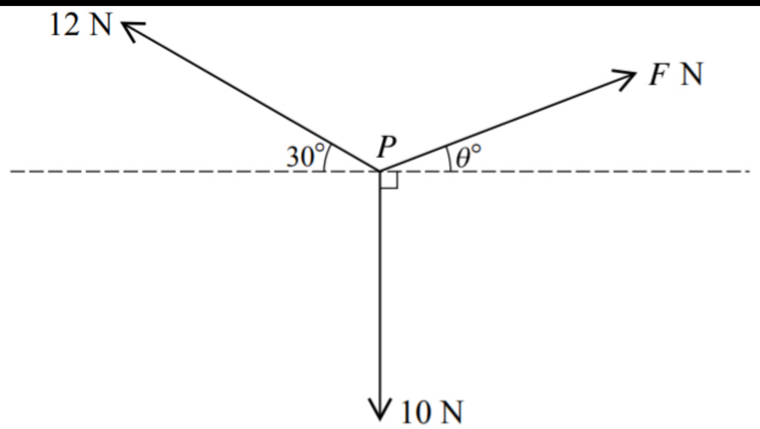
$\boxed{\theta = 29.74}$

$F^2(\sin^2\theta + \cos^2\theta) = 65$

$F^2(1) = 65$

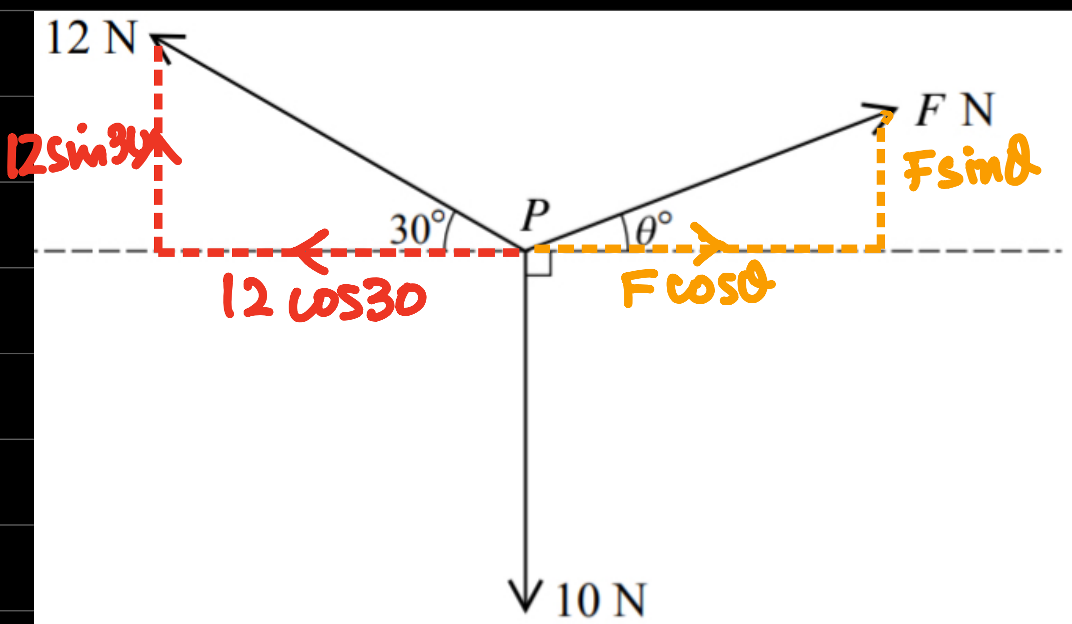
$F^2 = 65$

$\boxed{F = \sqrt{65}} = 8.0622.$



The three ~~coplanar~~ forces shown in the diagram act at a point P and are in equilibrium.

(i) Find the values of F and θ. [6]



up = down

$F\sin\theta + 12\sin 30 = 10$

$\boxed{F\sin\theta = 4}$

Left = Right

$12\cos 30 = F\cos\theta$

$F\cos\theta = 12\left(\sqrt{3}\right)$

(2)

$$\boxed{F\cos\theta = 6\sqrt{3}}$$

$(6\sqrt{3})^2$

$6^2(\sqrt{3})^2$

$36(3)$

108

STEP1

$$\frac{F\sin\theta}{F\cos\theta} = \frac{4}{6\sqrt{3}}$$

$$\tan\theta = \frac{2}{3\sqrt{3}}$$

$$\theta = \tan^{-1}\left(\frac{2}{3\sqrt{3}}\right)$$

$$\boxed{\theta = 21.05}$$

STEP2

$$F^2\sin^2\theta = 16$$

$$+\ F^2\cos^2\theta = 108$$

$$F^2\sin^2\theta + F^2\cos^2\theta = 124$$

$$F^2(\sin^2\theta + \cos^2\theta) = 124$$

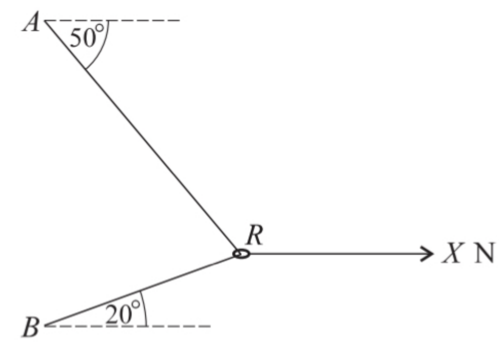
$$F^2(1) = 124$$

$$F^2 = 124$$

$$F = \sqrt{124}$$

$$\boxed{F = 11.1355}$$

1



$W = mg = 0.8 \times 10 = 8N$

A ~~light inextensible~~ string has its ends attached to two fixed points A and B, with A vertically above B. A smooth ring R, of mass 0.8 kg, is threaded on the string and is pulled by a horizontal force of magnitude X newtons. The sections AR and BR of the string make angles of 50° and 20° respectively with the horizontal, as shown in the diagram. The ring rests in equilibrium with the string taut. Find

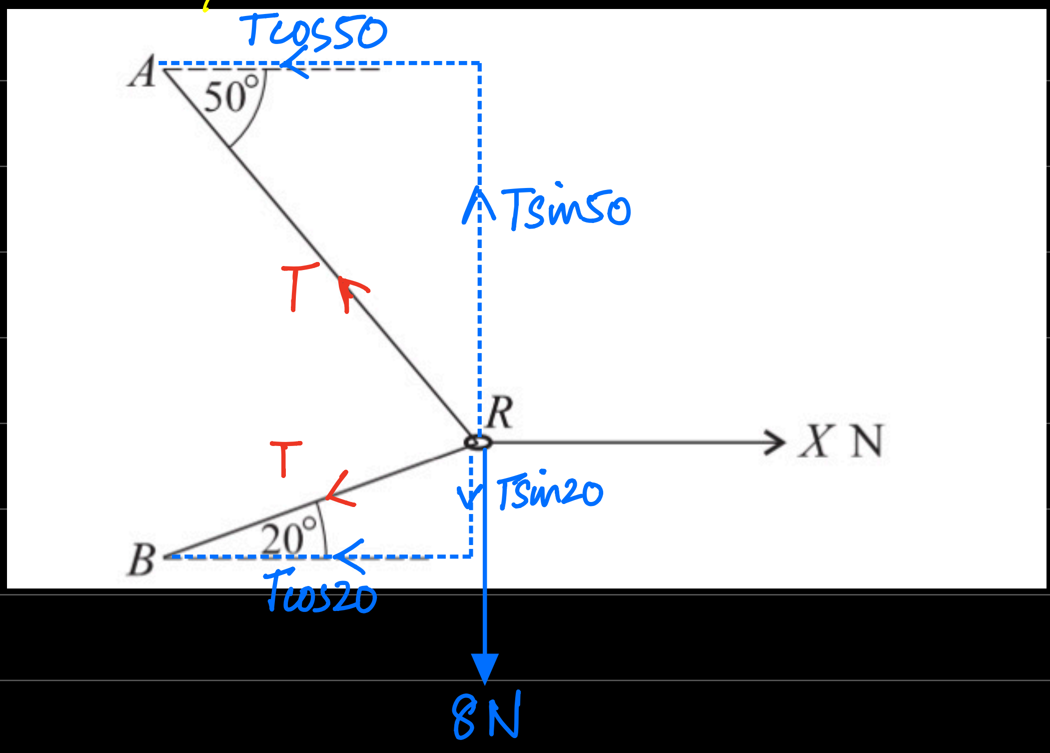
point of observation.

(i) the tension in the string, [3]

(ii) the value of X. [3]

NEVER MARK ANY FORCES ON THE DIAGRAM OF QUESTION.

DRAW A HUGE DIAGRAM FOR YOURSELF.



up = down

$T\sin 50 = 8 + T\sin 20$

$T\sin 50 - T\sin 20 = 8$

$T(\sin 50 - \sin 20) = 8$

$T = \dfrac{8}{\sin 50 - \sin 20}$

$T = 18.87.$

Left = Right.

$T\cos 50 + T\cos 20 = X$

$T(\cos 50 + \cos 20) = X$

$18.87(\cos 50 + \cos 20) = X$

$X = 29.86.$

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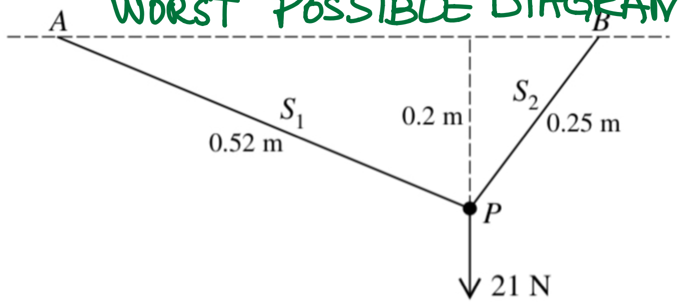
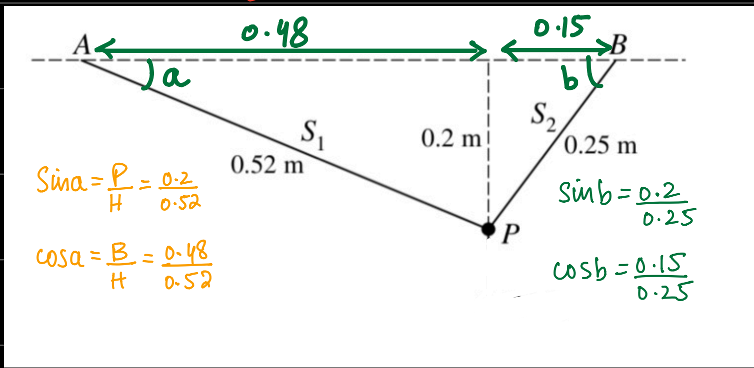
WORST POSSIBLE DIAGRAM. = You have both distances and forces on same diagram.



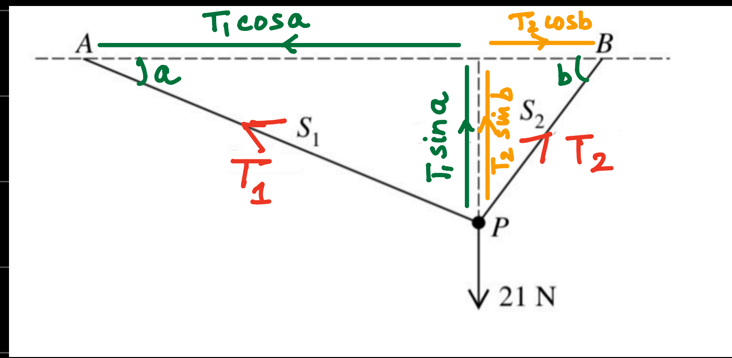
A particle P of weight 21 N is attached to one end of each of two ~~light inextensible~~ strings, S_1 and S_2, of lengths 0.52 m and 0.25 m respectively. The other end of S_1 is attached to a fixed point A, and the other end of S_2 is attached to a fixed point B at the same horizontal level as A. The particle P hangs in equilibrium at a point 0.2 m below the level of AB with both strings taut (see diagram). Find the tension in S_1 and the tension in S_2. [6]

EXAM TIP: DRAW SEPERATE DIAGRAMS FOR DISTANCES AND FORCES.

DISTANCES



FORCES.



STAY IN FRACTIONS THROUGHOUT QUESTION.

up = down

$$T_1 \sin a + T_2 \sin b = 21$$

$$T_1\left(\frac{0.2}{0.52}\right) + T_2\left(\frac{0.2}{0.25}\right) = 21$$

$$\boxed{\frac{5}{13}T_1 + \frac{4}{5}T_2 = 21}$$

Left = Right.

$$T_1 \cos a = T_2 \cos b$$

$$T_1\left(\frac{0.48}{0.52}\right) = T_2\left(\frac{0.15}{0.25}\right)$$

$$\frac{\cancel{12}^{4}}{13}T_1 = \frac{\cancel{3}^{1}}{5}T_2$$

$$\boxed{T_1 = \frac{13}{20}T_2}$$

Solving Simultaneously.

$$\frac{5}{13}\left(\frac{13}{20}\right)T_2 + \frac{4}{5}T_2 = 21$$

$$\frac{1}{4}T_2 + \frac{4}{5}T_2 = 21$$

$$\frac{21}{20}T_2 = 21$$

$$\boxed{T_2 = 20}$$

$$T_1 = \frac{13}{20} \times 20$$

$$\boxed{T_1 = 13}$$

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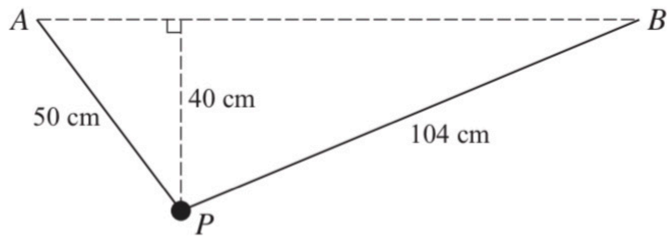

A particle P of mass 2.1 kg is attached to one end of each of two light inextensible strings. The other ends of the strings are attached to points A and B which are at the same horizontal level. P hangs in equilibrium at a point 40 cm below the level of A and B, and the strings PA and PB have lengths 50 cm and 104 cm respectively (see diagram). Show that the tension in the string PA is 20 N, and find the tension in the string PB. [5]

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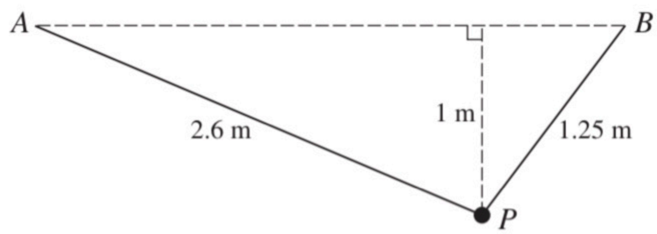

A particle P of mass 1.05 kg is attached to one end of each of two light inextensible strings, of lengths 2.6 m and 1.25 m. The other ends of the strings are attached to fixed points A and B, which are at the same horizontal level. P hangs in equilibrium at a point 1 m below the level of A and B (see diagram). Find the tensions in the strings. [6]