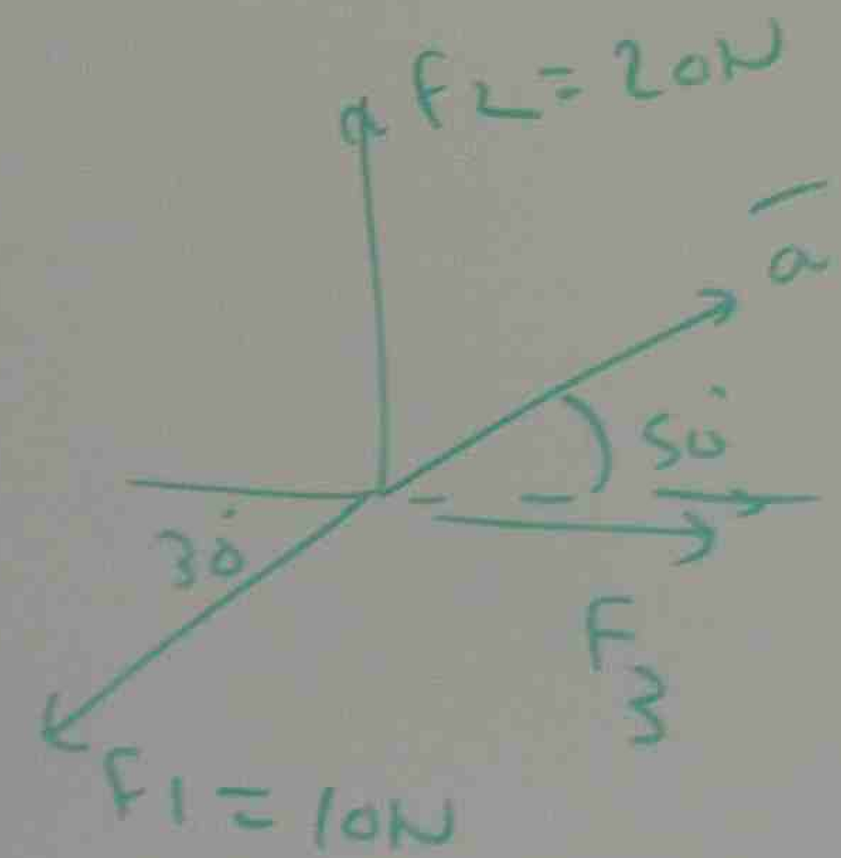
pb

2.0 kg COOKIE TIN IS ACCELERATED AT 3 m/s² IN THE DIRECTION SHOWN BY $\vec{a}$ OVER A FRICTIONLESS HORIZONTAL SURFACE.

THE ACCELERATION IS CAUSED BY THREE HORIZONTAL FORCE.

ONLY TWO OF WHICH ARE SHOWN $\vec{F_1}$ OF MAGNITUDE 10 N AND F_2 OF MAGNITUDE 20N.

WHAT IS THE THIRD FORCE $\vec{F_3}$ IN UNIT VECTOR NOTATION AND IN MAGNITUDE ANGLE NOTATION?



$$F_{NET} = m\,\vec{a}$$

$$= 2 \times 3 \cos 50$$

$$= 6 \cos 50$$

$$\vec{F} +$$

$$(+F_3) + (-F_1 \cos 30) = 6 \cos 50$$

$$F_3 - 10 \times 0.866 = 6 \cos 50$$

$F_3 = 6$

$=$

GRAVITA

$F_g = GR$

$m = MA$

$g = 9$

Z IN THE DIRECTION

SURFACE.

ORCE.

DE 10 N AND

NOTATION AND IN

$\vec{a}$

3 cos 50

cos 50

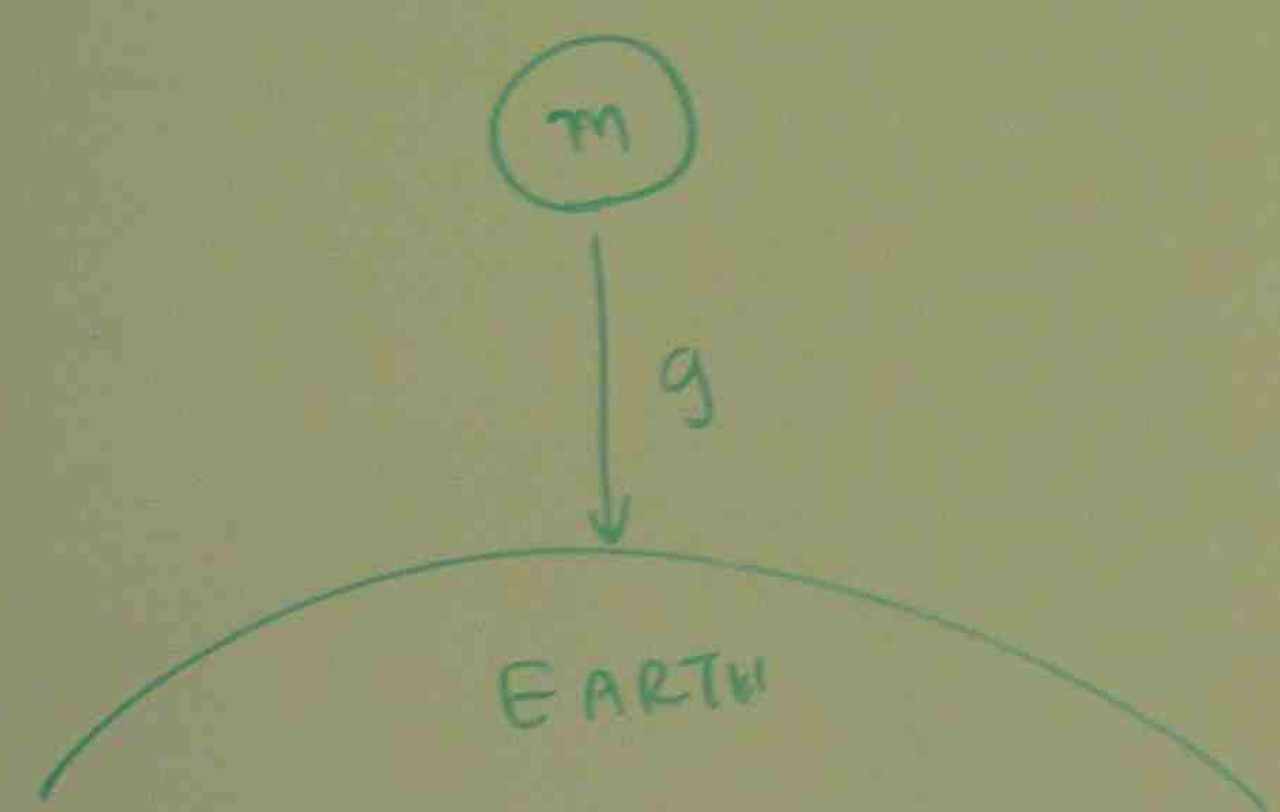
) = 6 cos 50

50 = 6 cos 50

$F_3 = 6 \cos 50 + 8.66$

$= 12.5$ N

GRAVITATIONAL FORCE

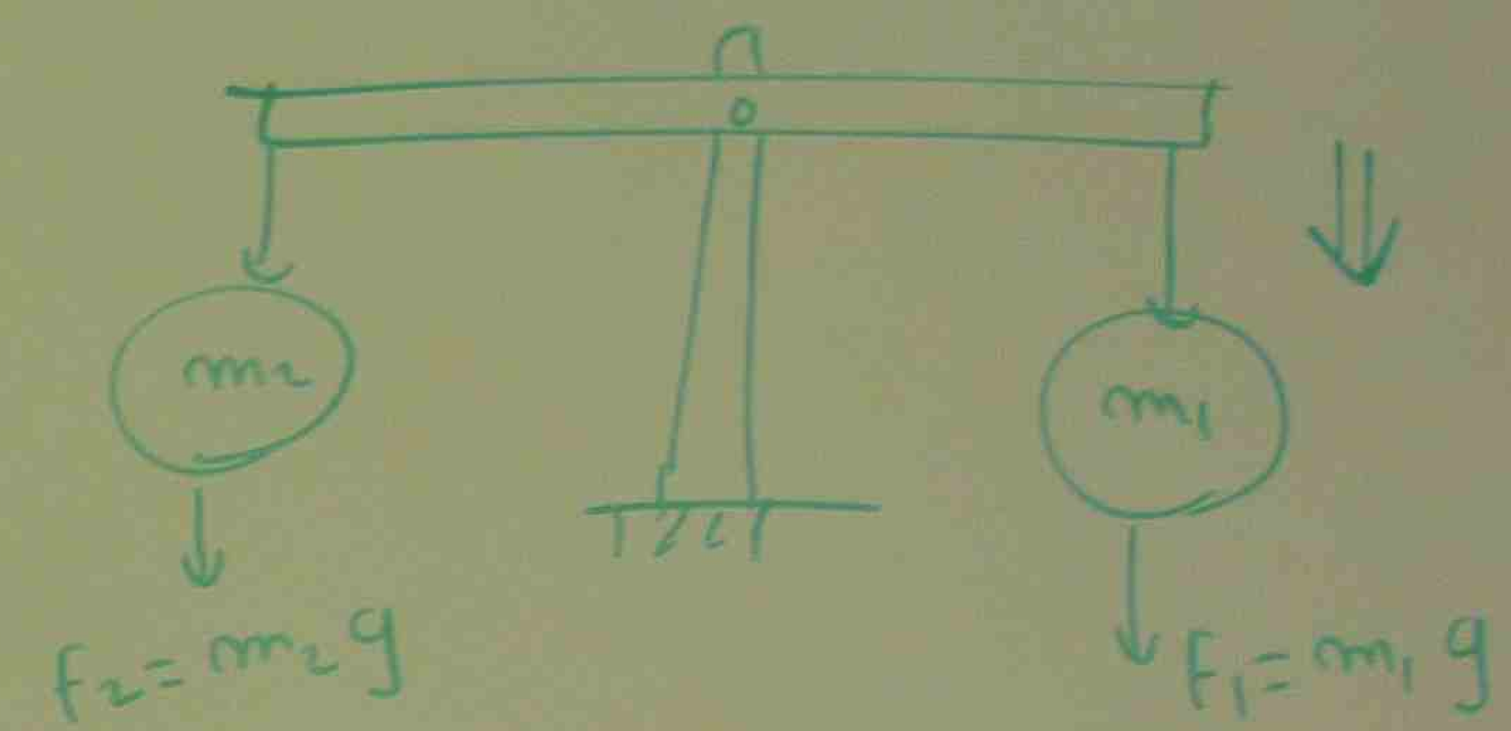


F_g = GRAVITATIONAL FORCE $= mg$
(N)

m = MASS (kg)

$g = 9.8\ m/s^2$

WEIGHT IS CAUSED BY GRAVITATIONAL FORCE



IF $F_1 > F_2$

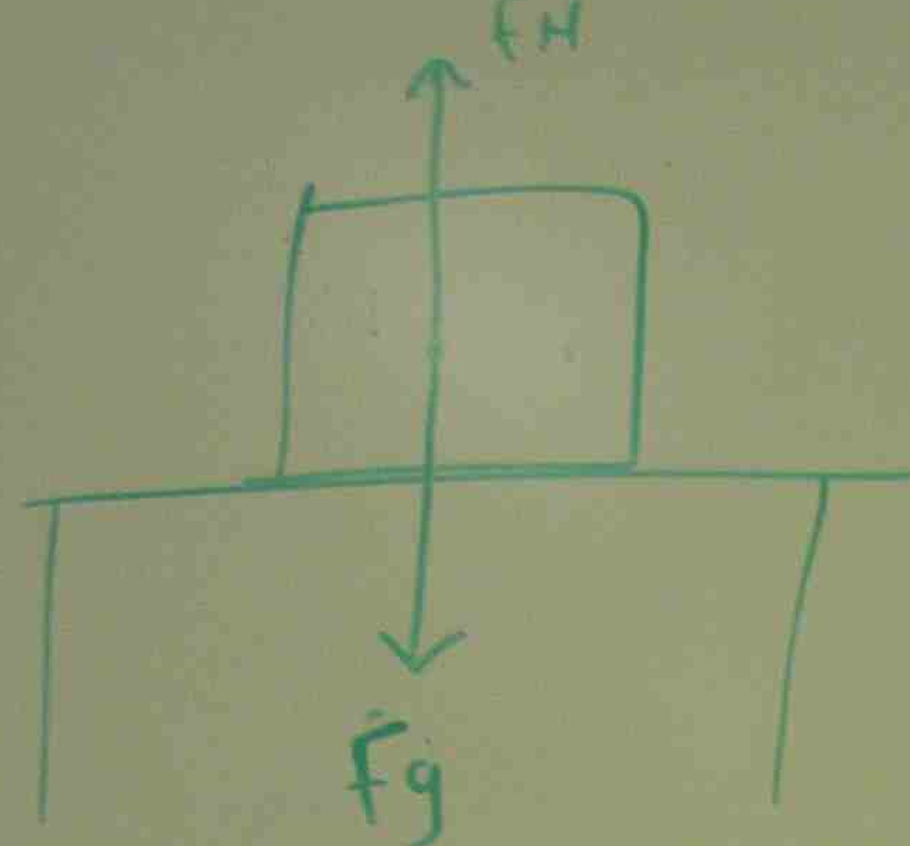
NET FORCE $= F_1 - F_2$

NET MASS × NET ACCELERATION $= m_1 g - m_2 g$

$(m_1 + m_2)\, a_N = m_1 g - m_2 g$

$a_N = \dfrac{m_1 g - m_2 g}{m_1 + m_2}$

AL FORCE



AT STATIONARY $\uparrow F_N = F_g \downarrow$

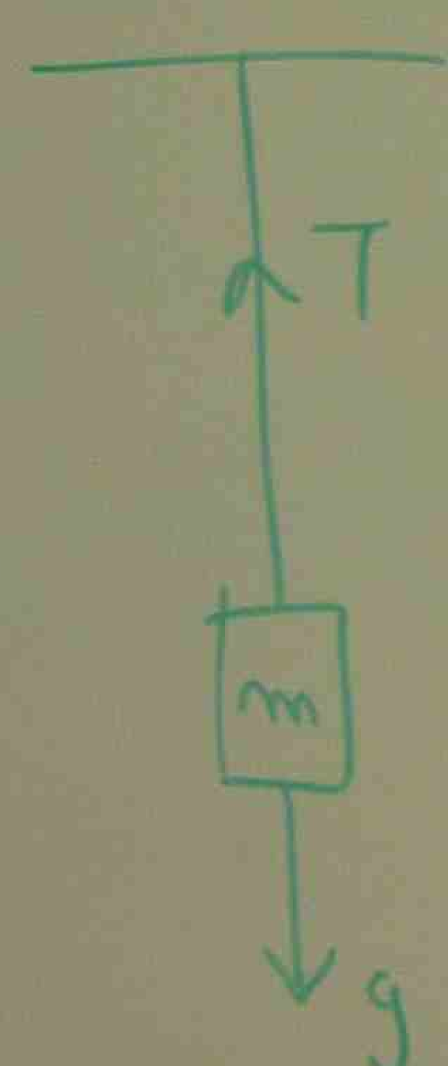
F_2

$m_2 g$

$m_2 g$

$m_2 g$

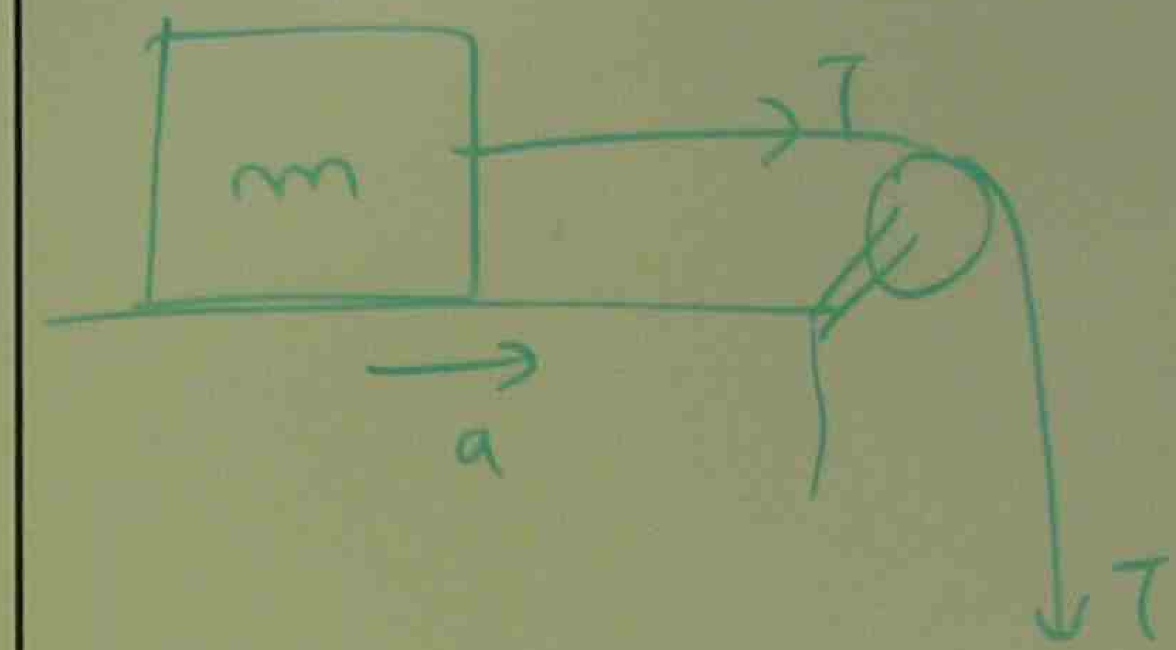
m_2



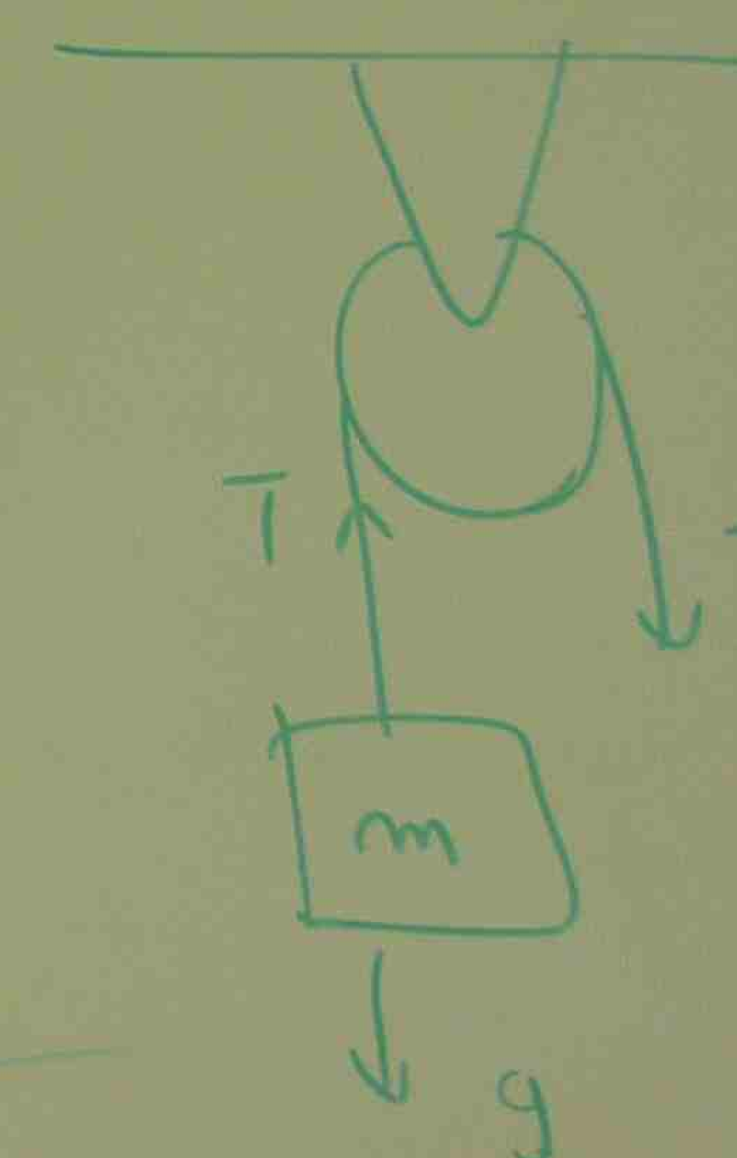
$F = mg$

TENSION

$T = F = mg$ (N)



$T = m\,a$



$T = m \times g$

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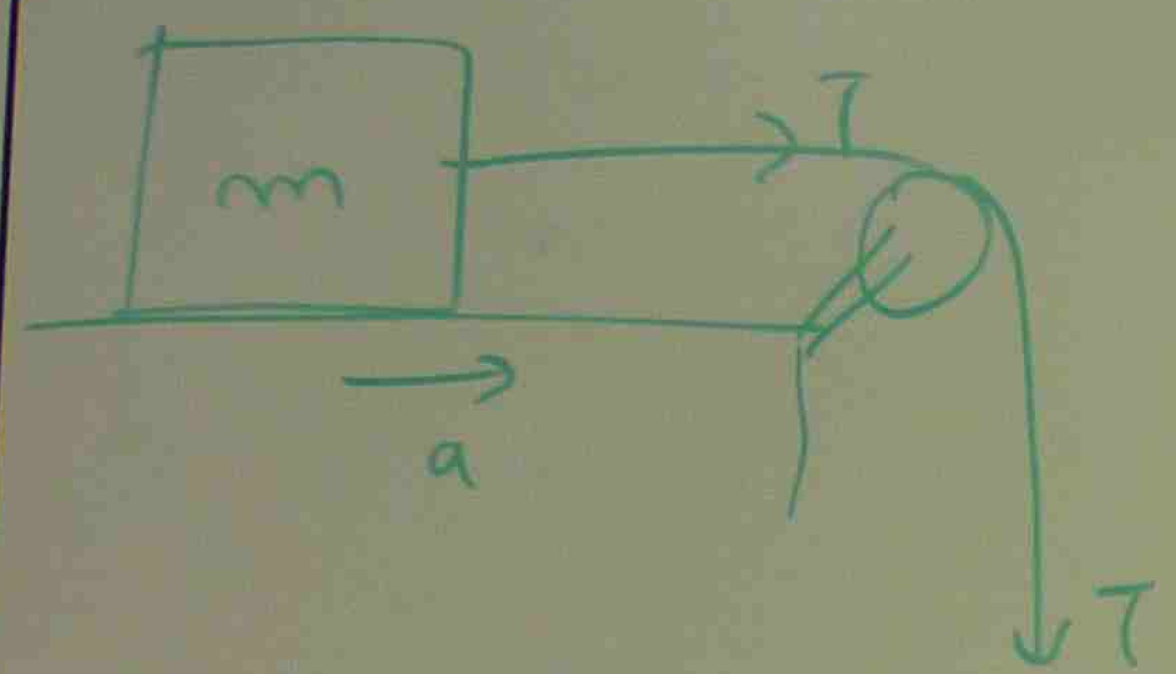
(a)

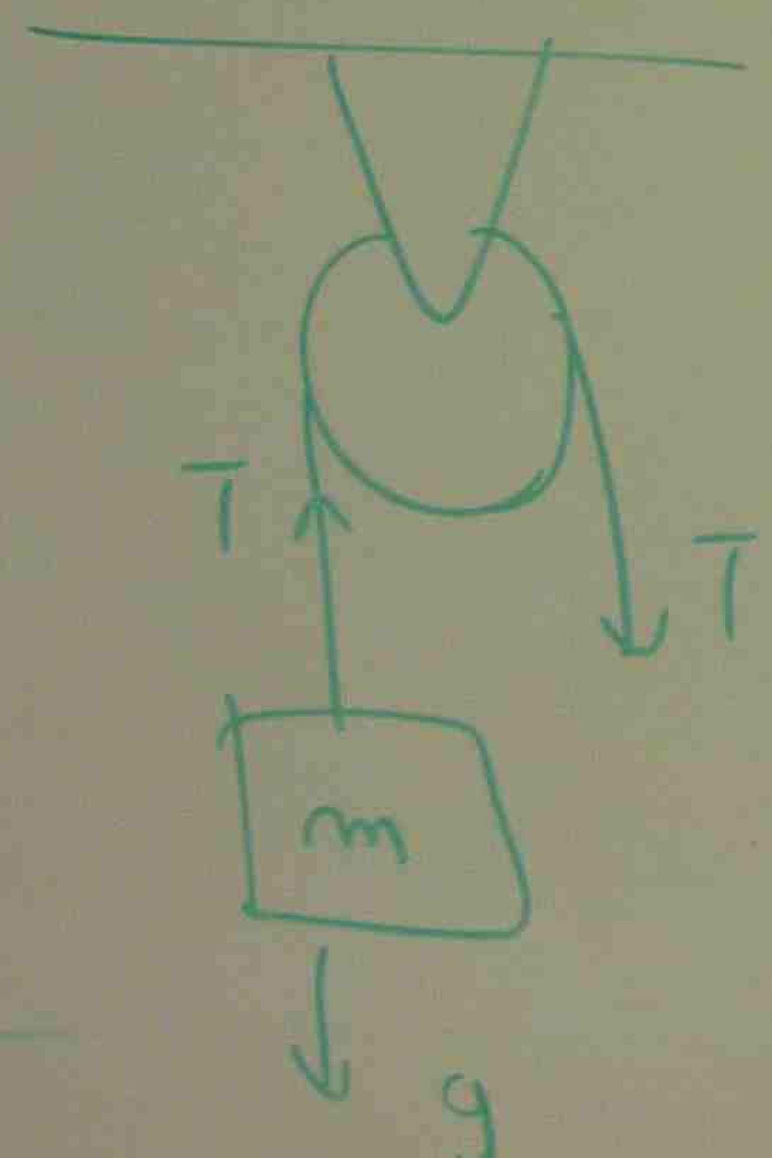
(b)

(c

ng (N)

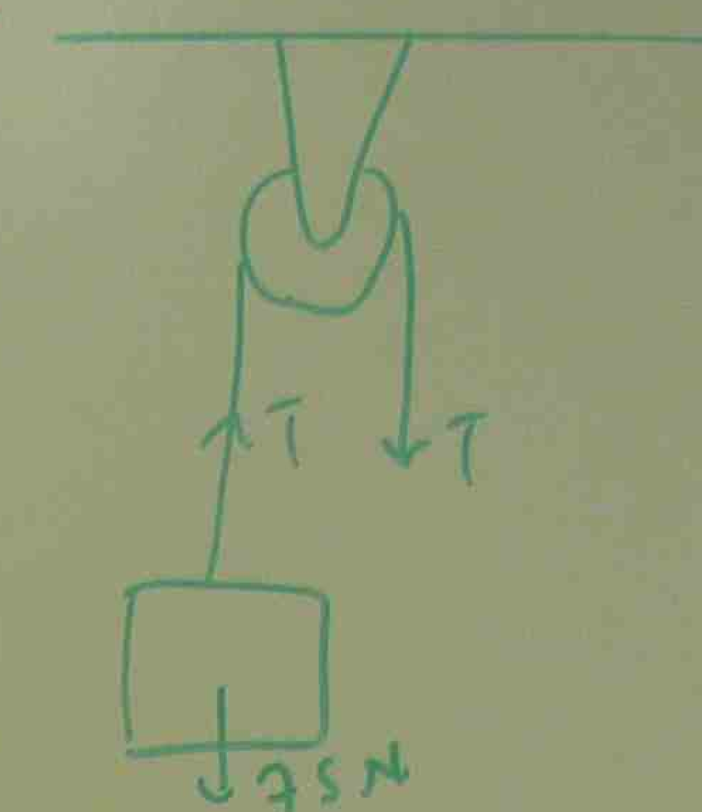


$T = m\ a$



$T = m \times g$

pb



THE SUSPENDED BODY IN FIGURE WEIGHS 75 N

IS T EQUAL TO (OR) GREATER THAN (OR) LESS THAN 75 N WHEN THE BODY IS MOVING UPWARD

(a) AT CONSTANT SPEED

(b) AT INCREASE SPEED

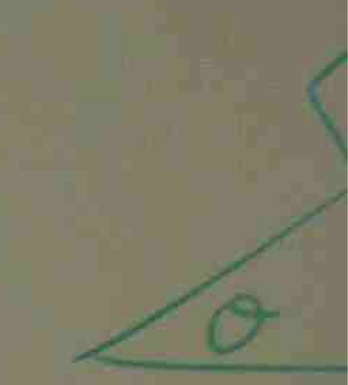
(c) AT DECREASING SPEED.

(a) $T > 75\,N$

(b) $T > 75\,N$

(c) $T < 75\,N$

pb



A CORD

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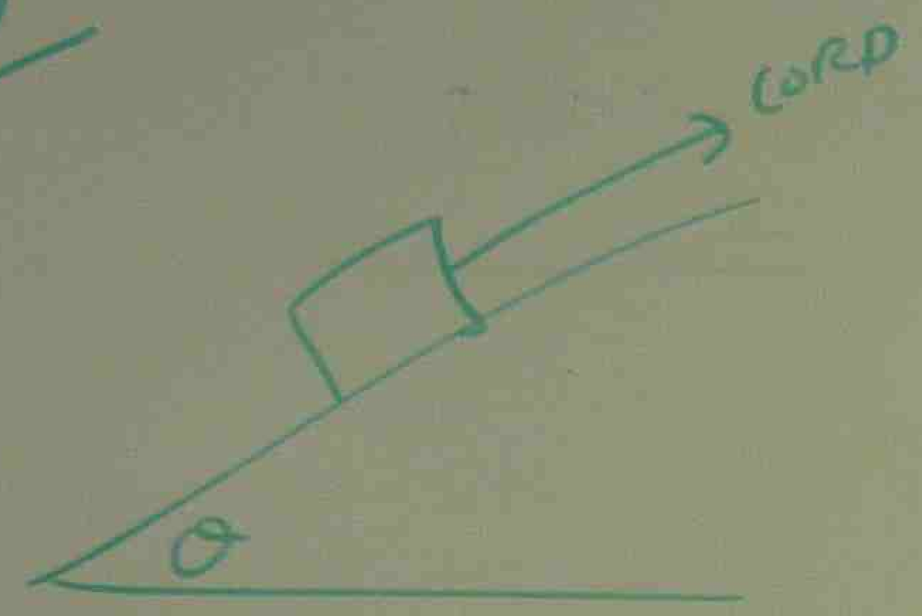
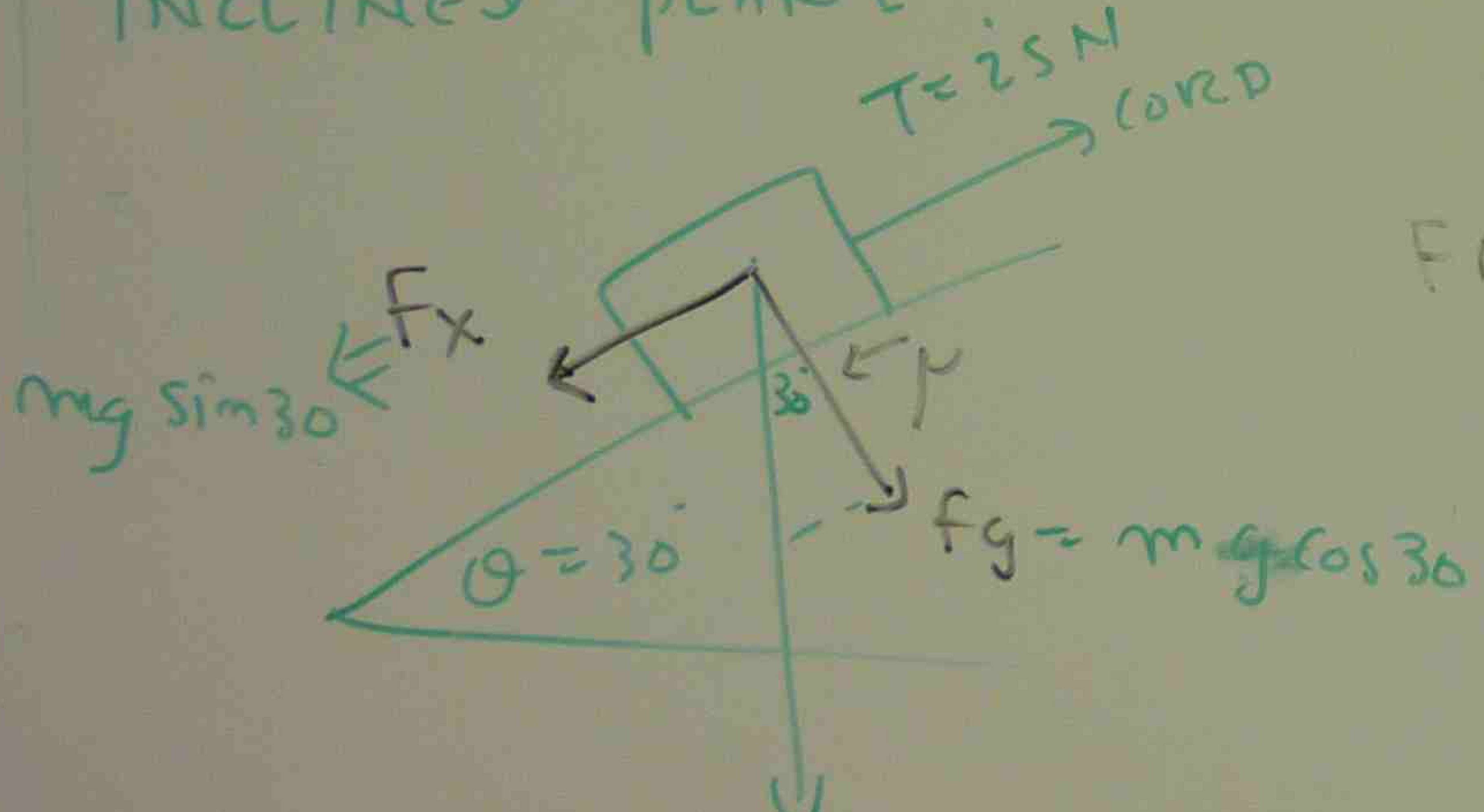
mg sin30

pb



A CORD PULLS ON A BOX OF SEA BISCUITS UP ALONG A FRICTIONLESS PLANE INCLINED AT $\theta = 30^\circ$. THE BOX HAS MASS $m = 5$ kg AND THE FORCE FROM THE CORD HAS MAGNITUDE $T = 25$ N. WHAT IS THE BOX'S ACCELERATION COMPONENT (a) ALONG THE INCLINED PLANE?



$m = 5$ kg

$F = mg = 5 \times 9.8 = 49$ N

FRICTIONAL FORCE $= \mu\, f_y$

$$F_x = mg\sin 30$$
$$= 5 \times 9.8 \times 0.5$$
$$= 49 \times 0.5$$
$$= 24.5 \text{ N}$$

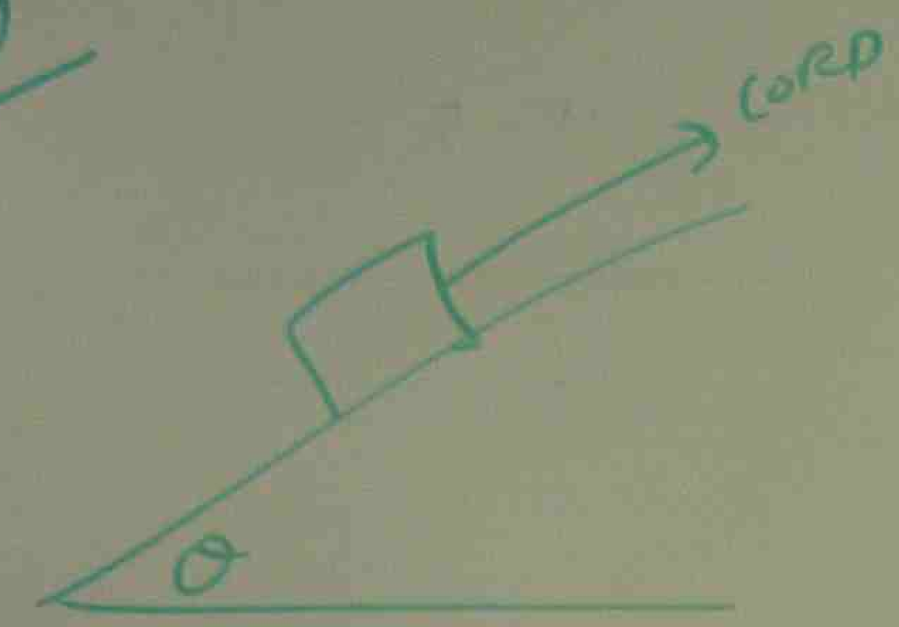
$T = 25$ N

$$\text{NET FORCE} = T - f_x$$
$$= 25 - 24.5$$
$$= 0.5 \text{ N}$$

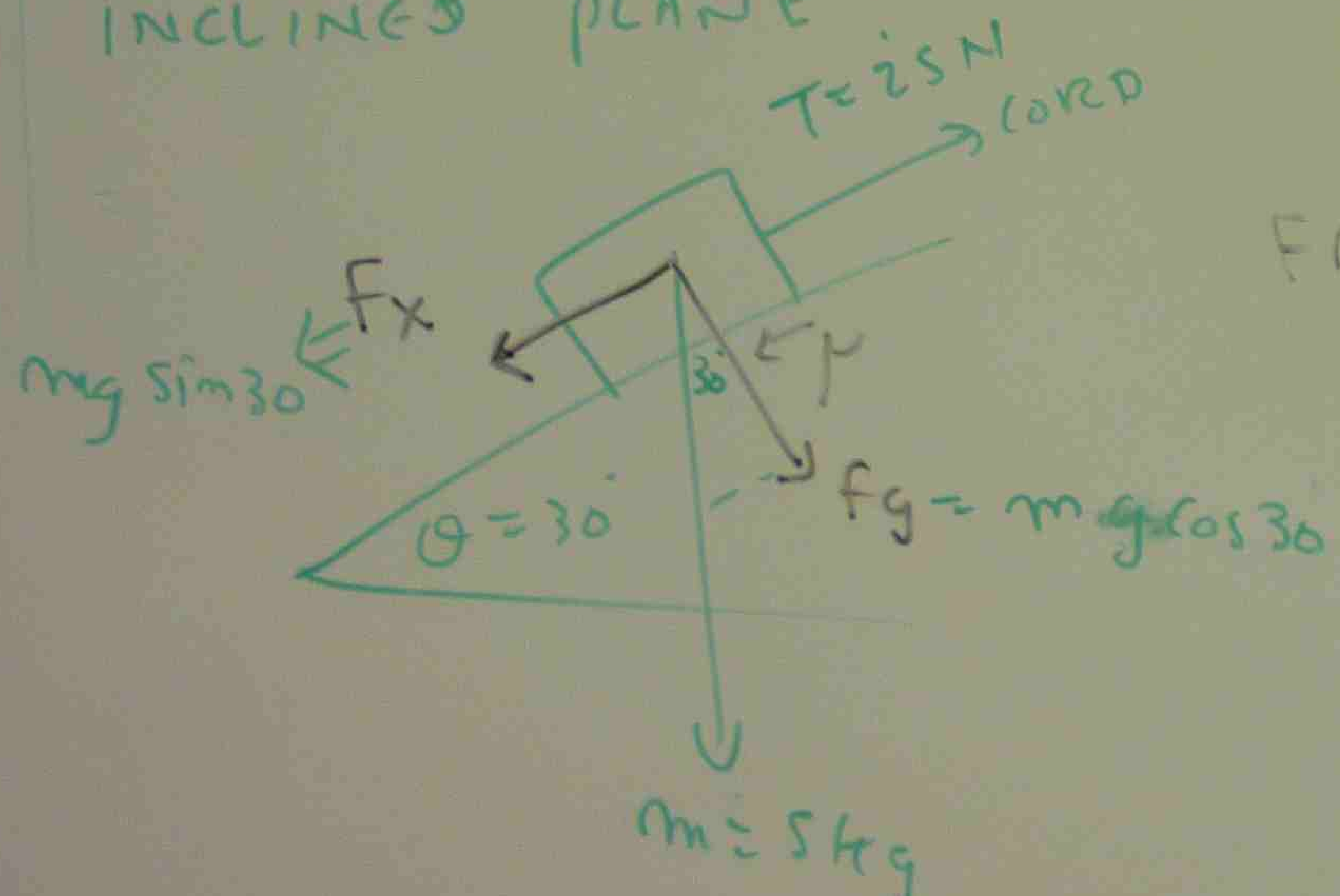
$$a = \frac{\text{NET FORCE}}{\text{MASS}}$$
$$= \frac{0.5 \text{ N}}{5 \text{ kg}}$$
$$= 0.1 \text{ m/s}^2$$

45 N
(or)
IS
SPEED
SPEED
NG

pb



A CORD PULLS ON A BOX OF SEA BISCUITS UP ALONG A FRICTIONLESS PLANE INCLINED AT $\theta = 30^\circ$. THE BOX HAS MASS $m = 5$ kg AND THE FORCE FROM THE CORD HAS MAGNITUDE $T = 25$ N. WHAT IS THE BOX'S ACCELERATION COMPONENT (a) ALONG THE INCLINED PLANE?



$F = mg = 5 \times 9.8 = 49$ N

FRICTIONAL FORCE $= \mu f_y$

$F_x = mg \sin 30$
$= 5 \times 9.8 \times 0.5$
$= 49 \times 0.5$
$= 24.5$ N

$T = 25$ N

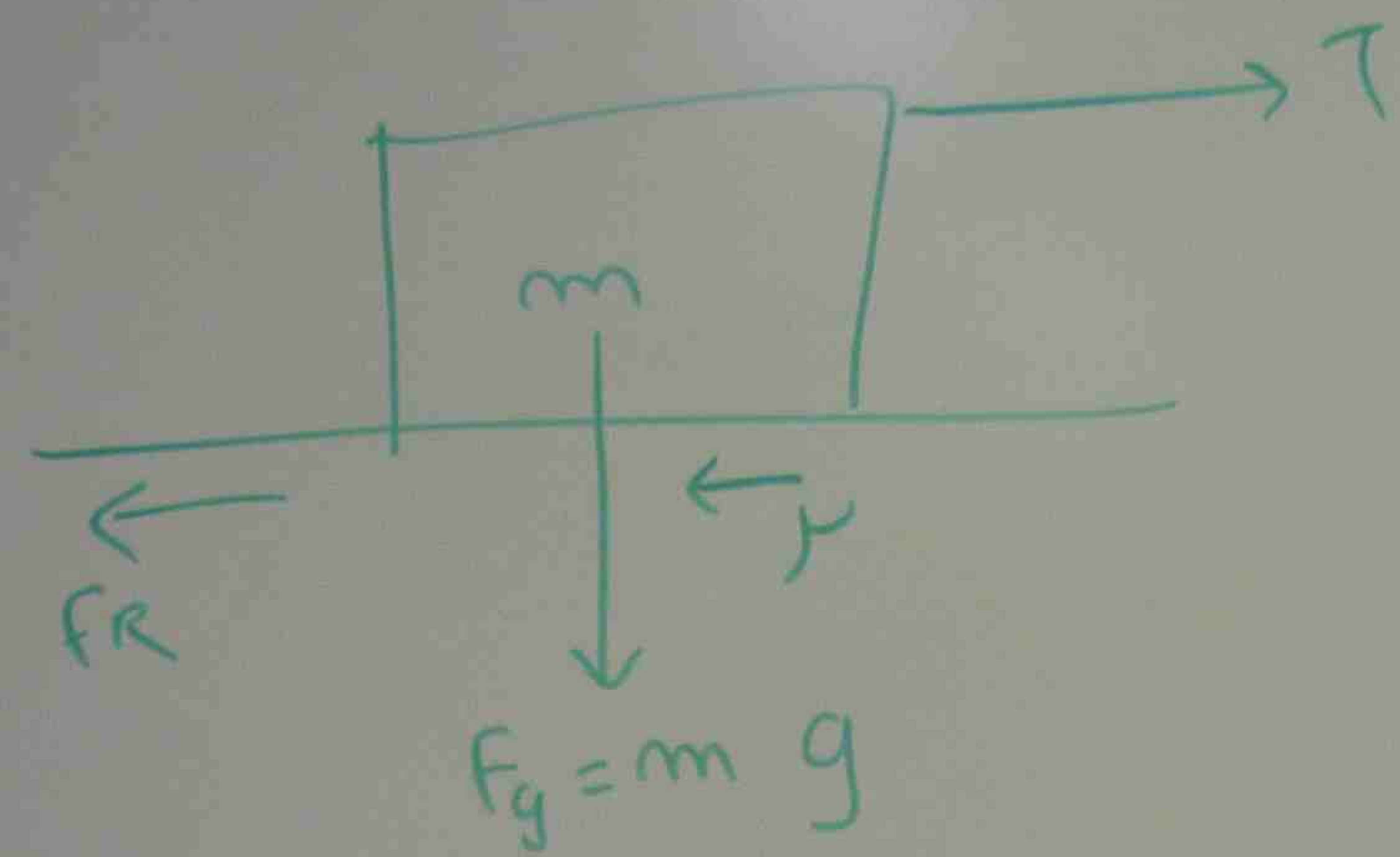
NET FORCE $= T - F_x$
$= 25 - 24.5$
$= 0.5$ N

$$a = \frac{\text{NET FORCE}}{\text{MASS}}$$

$$= \frac{0.5\text{ N}}{5\text{ kg}}$$

$= 0.1\ m/s^2$

FRICTION



F_g = GRAVITATIONAL FORCE

m = MASS

g = GRAVITATION

To move the block by pulling, it needs to overcome the frictional force at least

$T = F_R$

$T = mg\mu$

F_R = FRICTIONAL FORCE = PERPENDICULAR FORCE × FRICTION COEFFICIENT

$= F_g \times \mu$

$= mg\mu$

...CK BY PULLING,

... OVERCOME THE

...CE AT LEAST

...ON

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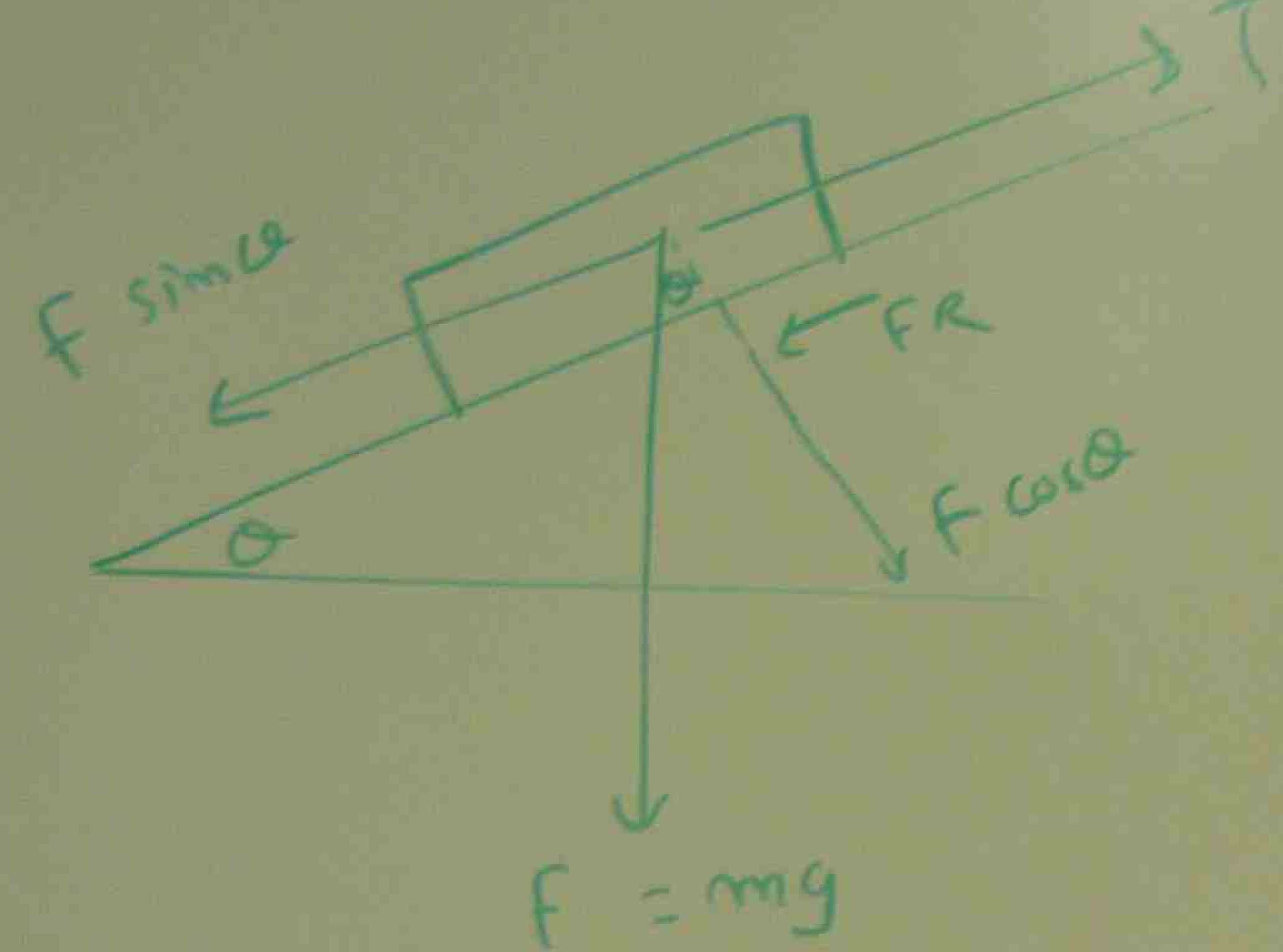


$FR = F\cos\theta\,\mu$

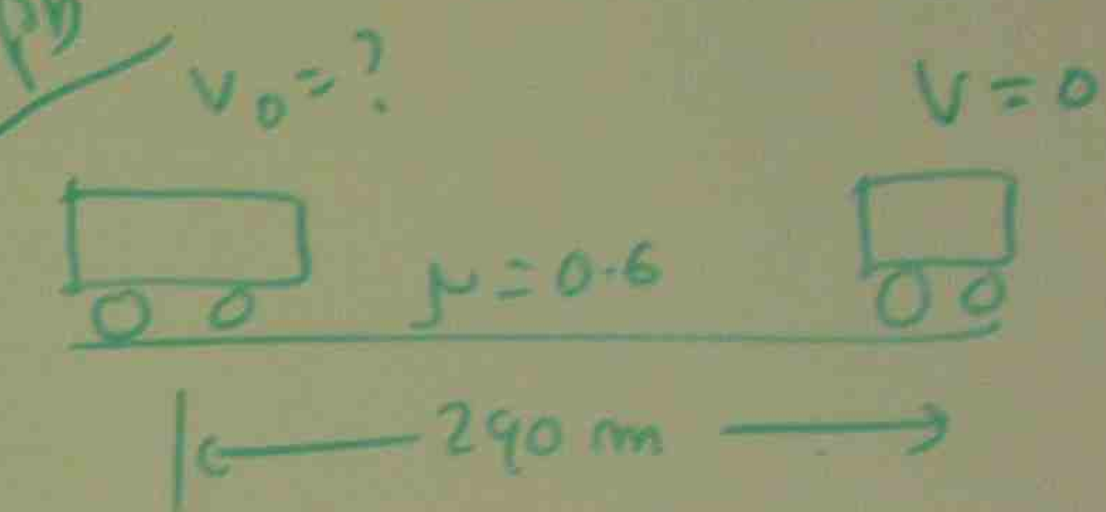
IF THE BLOCK POSITIONED ON INCLINED PLANE IS STATIONARY

$T = F\sin\theta + FR$

$T = F\sin\theta + F\cos\theta\,\mu$

WHERE $F = mg$

Pb



THE CAR WAS STOPPED AFTER HAVING MOVED 290m WHEN THE BRAKE WAS APPLIED. WHAT IS INITIAL VELOCITY? AND FRICTIONAL FORCE IF MASS IS 500kg.

$V^2 = v_0^2$ ...

$0^2 = v_0^2$ ...

$v_0^2 = 2$ ...

$F = \mu$ ...

$F = 0.$ ...

$= 2$ ...

$F =$ ...

$2940 = 5$ ...

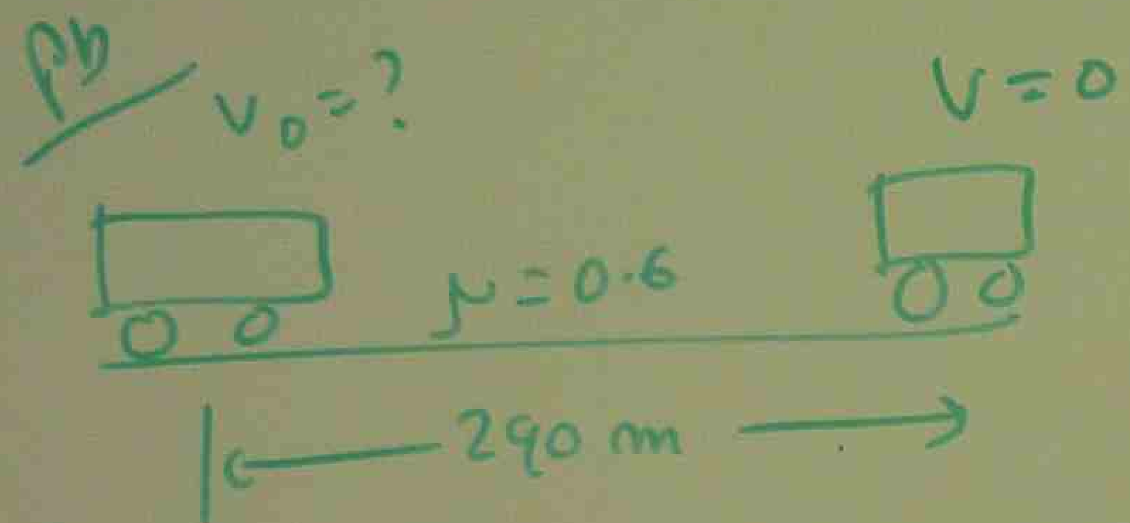
$a =$ ...

$v_0^2 = 2a$ ...

$v_0 =$ ...

WHERE $f = mg$

pb



THE CAR WAS STOPPED AFTER HAVING MOVED 290m WHEN THE BRAKE WAS APPLIED. WHAT IS INITIAL VELOCITY? AND FRICTIONAL FORCE IF MASS IS 500kg.

$$V^2 = V_0^2 - 2as$$

$$0^2 = V_0^2 - 2 \times a \times 290$$

$$V_0^2 = 2a \times 290 \quad \text{--- } 1$$

$$F = \mu mg$$

$$F = 0.6 \times 500 \times 9.8$$

$$= 2940\,N$$

$$F = ma$$

$$2940 = 500\,a$$

$$a = \frac{2940}{500} = 5.88\,m/s^2$$

$$V_0^2 = 2a \times 290 = 2 \times 5.88 \times 290$$

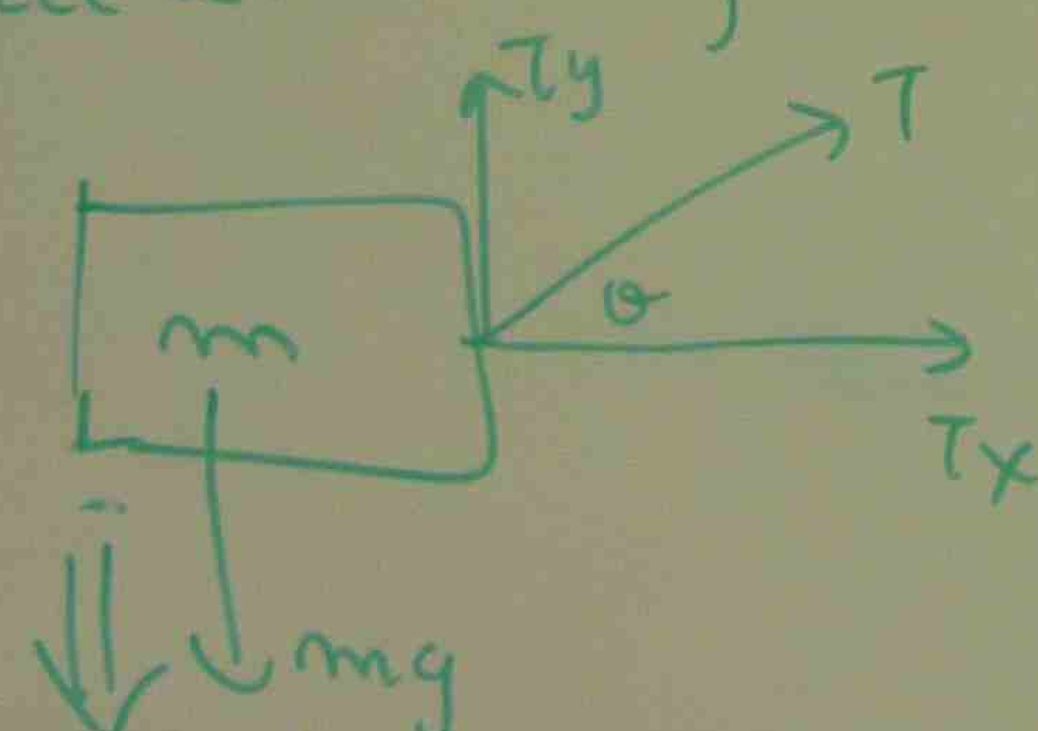
$$V_0 = \sqrt{2 \times 5.88 \times 290} = 58.3\,m/s$$

PD

m = 3 kg SLIDE, $\vec{F}$ = 12 N
IS APPLIED TO IT.

$\mu = 0.4$, $\theta = 0 \rightarrow 90°$

WHAT IS THE MAXIMUM VALUE OF θ
GIVES THE MAXIMUM VALUE OF
BLOCK ACCELERATION, a = ?



$F_{y\,NET} = \downarrow mg - T_y \uparrow$

$F_{y\,NET} = 3 \times 9.81 - T \sin\theta$ — (1)

$T_x = T \cos\theta$

T_x = FRICTIONAL FORCE

$T\cos\theta = F_{y\,NET} \times \mu$

$12\cos\theta = (3 \times 9.81 - T\sin\theta)\, 0.4$

$\frac{12\cos\theta}{0.4} = 29.43 - 12\sin\theta$

$30\cos\theta = 29.43 - 12\sin\theta$

$12\sin\theta + 30\cos\theta = 29.43$

θ = 0

LHS

12 simθ -

To GE

N

θ

$$F_{y\,NET} = 3 \times 9.81 - T\sin\theta \quad — 1$$

$$T_x = T\cos\theta$$

$$T_x = \text{FRICTIONAL FORCE}$$

$$T\cos\theta = F_{y\,NET} \times \mu$$

$$12\cos\theta = (3 \times 9.81 - T\sin\theta)\,0.4$$

$$\frac{12\cos\theta}{0.4} = 29.43 - 12\sin\theta$$

$$30\cos\theta = 29.43 - 12\sin\theta$$

$$12\sin\theta + 30\cos\theta = 29.43$$

$\theta = 0$

<u>LHS</u>

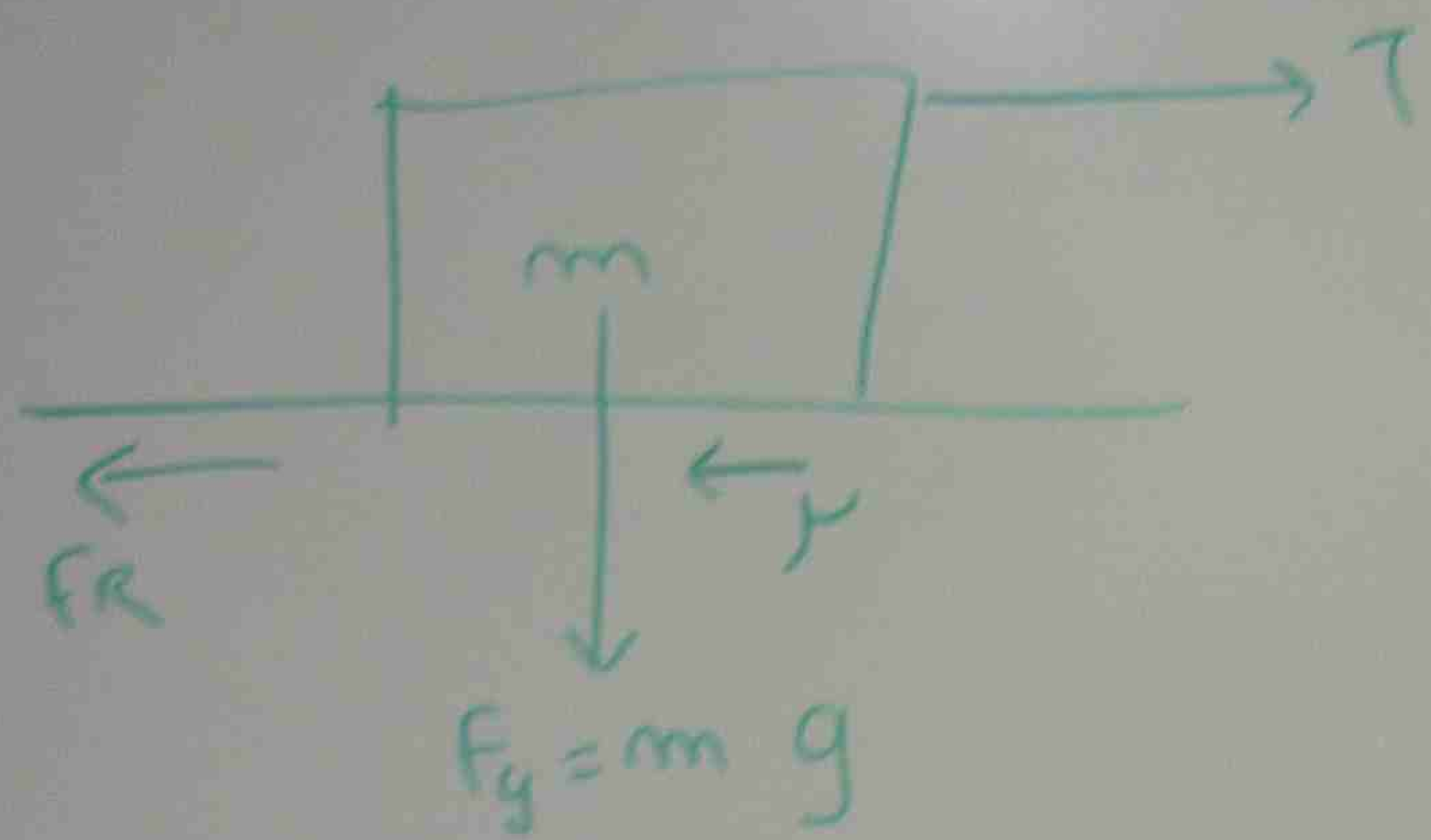
$$12\sin 0 + 30\underset{\substack{\uparrow\\0}}{\cos\theta} = 30$$

$$\text{RHS} \simeq 29.43$$

TO GET MAXIMUM MOMENT $\theta = 0$.

Box

FRICTION



F_g = GRAVITATIONAL FORCE

m = MASS

g = GRAVITATION

TO MOVE THE BLOCK BY PULLING, IT NEEDS TO OVERCOME THE FRICTIONAL FORCE AT LEAST

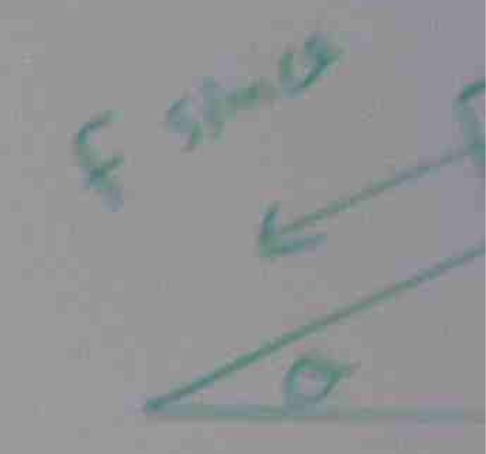
$$T = F_R$$

$$T = mg\mu$$

F_R = FRICTIONAL FORCE = PERPENDICULAR FORCE $\times$ FRICTION COEFFICIENT

$$= F_g \times \mu$$

$$= mg\mu$$



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AT LEAST

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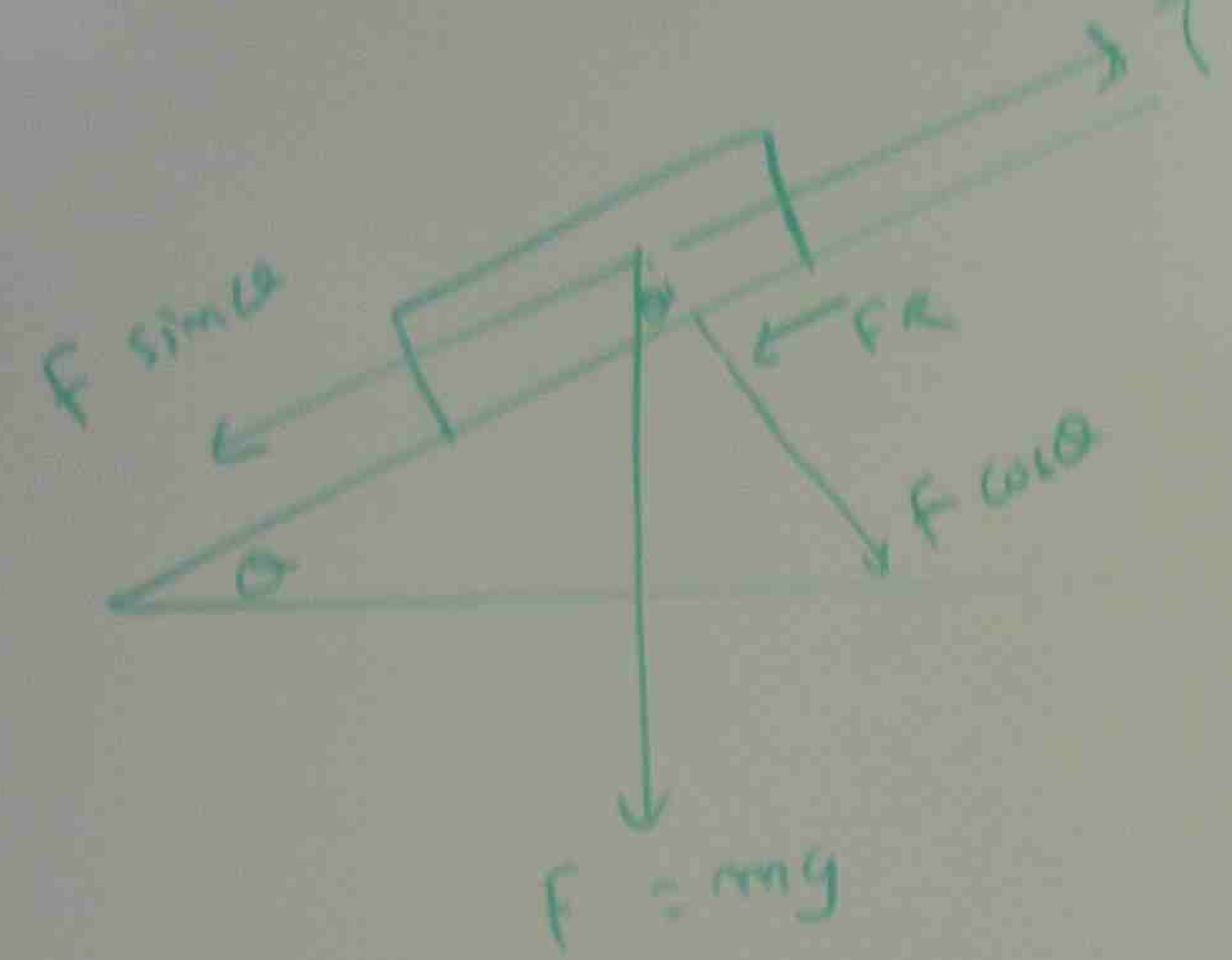


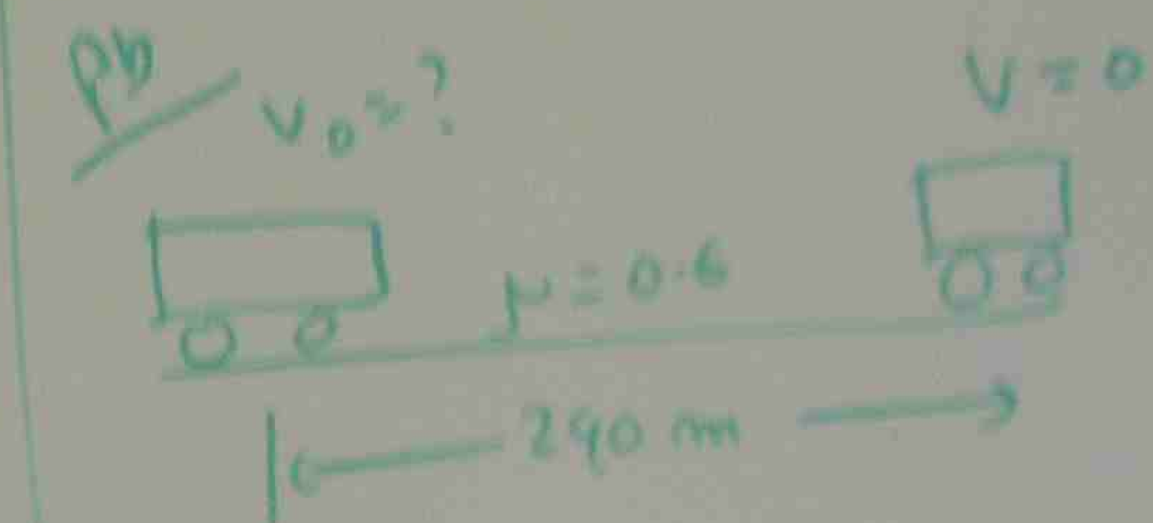
$FR = F\cos\theta\,\mu$

IF THE BLOCK POSITIONED ON INCLINED PLANE IS STATIONARY

$T = F\sin\theta + FR$

$T = F\sin\theta + F\cos\theta\,\mu$

WHERE $F = mg$



THE CAR WAS STOPPED AFTER HAVING MOVED 240m WHEN THE BRAKE WAS APPLIED. WHAT IS INITIAL VELOCITY? AND FRICTIONAL FORCE IF MASS IS 500kg.

$V^2 = V_0^2 - 2as$

$0^2 = V_0^2 - 2 \times a \times$

$V_0^2 = 2a \times 24$

$F = \mu m g$

$F = 0.6 \times 50$

$= 2940$

$F = ma$

$2940 = 500$

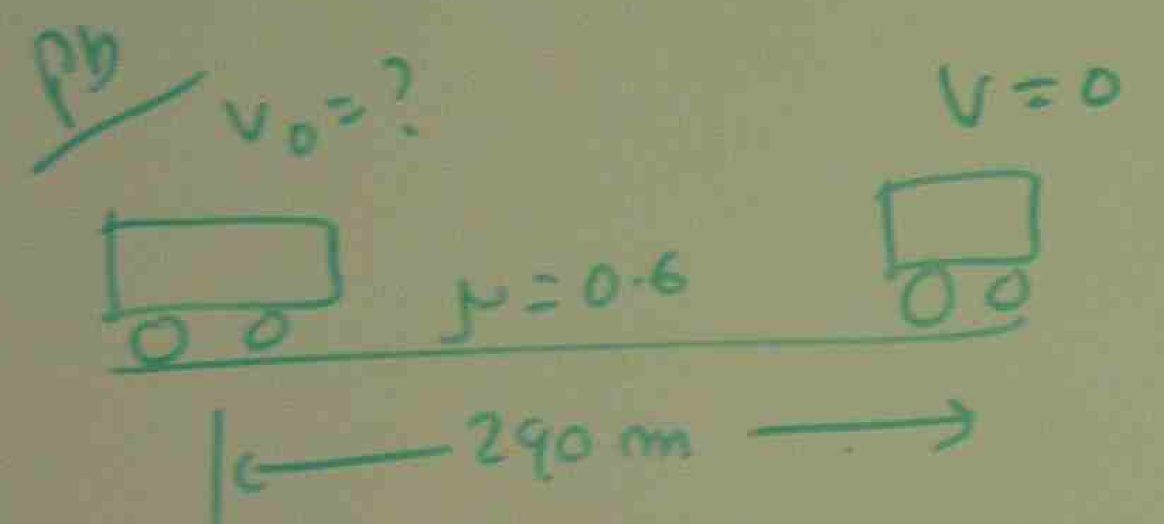
$a = \frac{2940}{500}$

$V_0^2 = 2a \times 240$

$V_0 = \sqrt{2 \times 5.}$

WHERE $F = mg$

pb



THE CAR WAS STOPPED AFTER HAVING MOVED 290m WHEN THE BRAKE WAS APPLIED. WHAT IS INITIAL VELOCITY? AND FRICTIONAL FORCE IF MASS IS 500kg.

$$V^2 = v_0^2 - 2as$$

$$0^2 = v_0^2 - 2 \times a \times 290$$

$$v_0^2 = 2a \times 290 \qquad (1)$$

$$F = \mu m g$$

$$F = 0.6 \times 500 \times 9.8$$

$$= 2940\,N$$

$$F = ma$$

$$2940 = 500\,a$$

$$a = \frac{2940}{500} = 5.88\,m/s^2$$

$$v_0^2 = 2a \times 290 = 2 \times 5.88 \times 290$$

$$v_0 = \sqrt{2 \times 5.88 \times 290} = 58.3\,m/s$$

T

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FR

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pb

$m = 3$

IS APPL

$\psi =$

WHAT

GIVES

BLOCK

F

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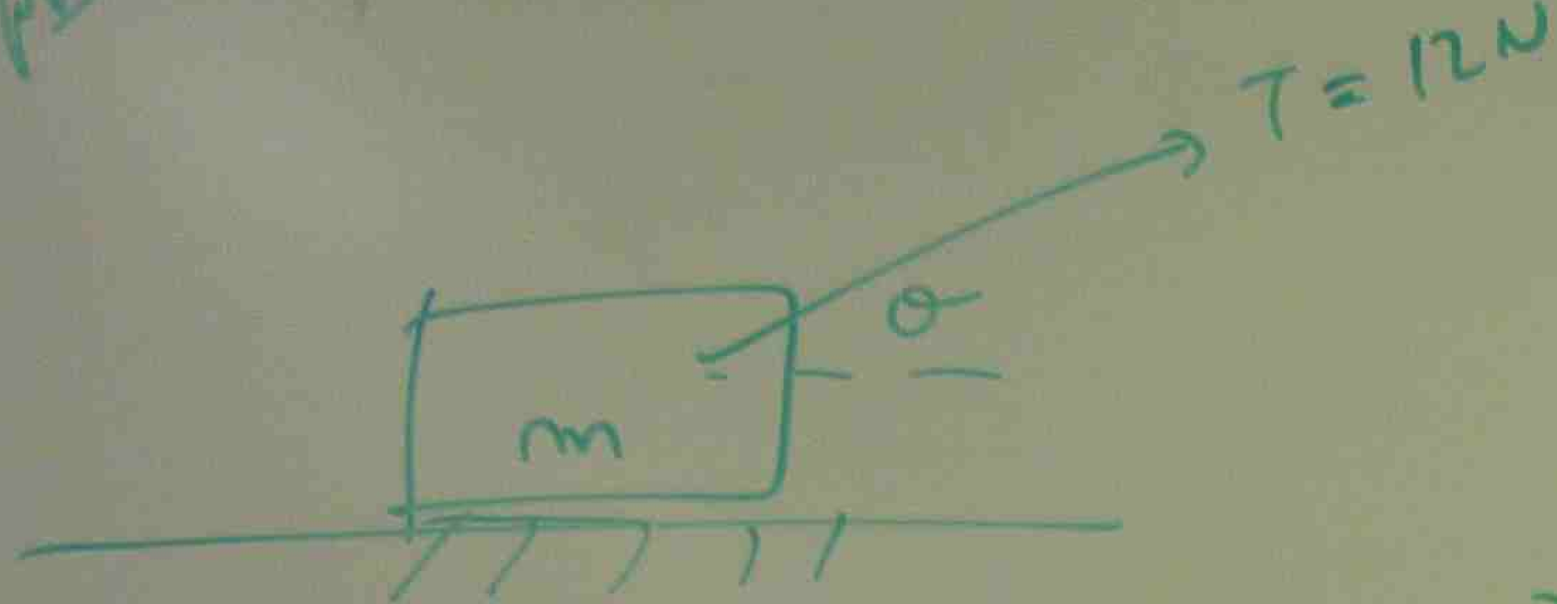
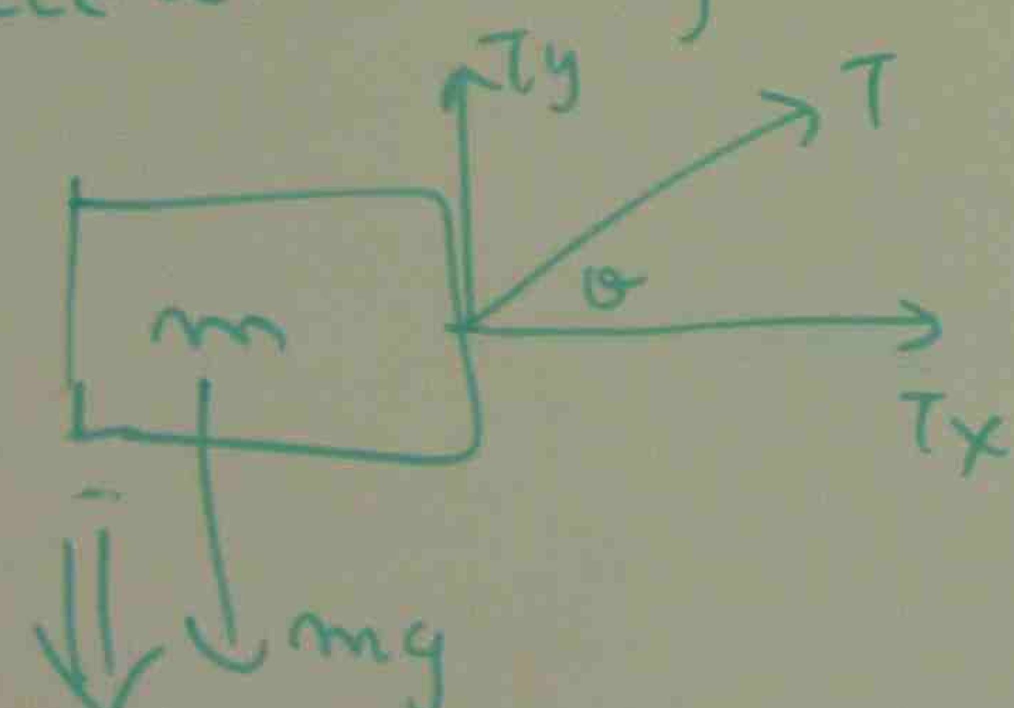


m = 3 kg SLIDE, $\vec{F} = 12$ N IS APPLIED TO IT.

$\mu = 0.4$, $\theta = 0 \rightarrow 90°$

WHAT IS THE MAXIMUM VALUE OF θ GIVES THE MAXIMUM VALUE OF BLOCK ACCELERATION, $a = ?$.



$$F_{y\,NET} = \downarrow mg - T_y \uparrow$$

$$F_{y\,NET} = 3 \times 9.81 - T\sin\theta \quad \text{— (1)}$$

$$T_x = T\cos\theta$$

T_x = FRICTIONAL FORCE

$$T\cos\theta = F_{y\,NET} \times \mu$$

$$12\cos\theta = (3 \times 9.81 - T\sin\theta)\,0.4$$

$$\frac{12\cos\theta}{0.4} = 29.43 - 12\sin\theta$$

$$30\cos\theta = 29.43 - 12\sin\theta$$

$$12\sin\theta + 30\cos\theta = 29.43$$

$\theta = 0$

LHS

$12\sin\theta + 3$...

To GET ...

N

f θ

$F_{y\,NET} = 3 \times 9.81 - T\sin\theta$ — 1

$T_x = T\cos\theta$

T_x = FRICTIONAL FORCE

$T\cos\theta = F_{y}\,NET \times \mu$

$12\cos\theta = (3 \times 9.81 - T\sin\theta)\,0.4$

$\frac{12\cos\theta}{0.4} = 29.43 - 12\sin\theta$

$30\cos\theta = 29.43 - 12\sin\theta$

$12\sin\theta + 30\cos\theta = 29.43$

$\theta = 0$

LHS

$12\sin\theta + 30\cos\theta = 30$

0

RHS $\simeq 29.43$

TO GET MAXIMUM MOMENT $\theta = 0$.

BOX

NET