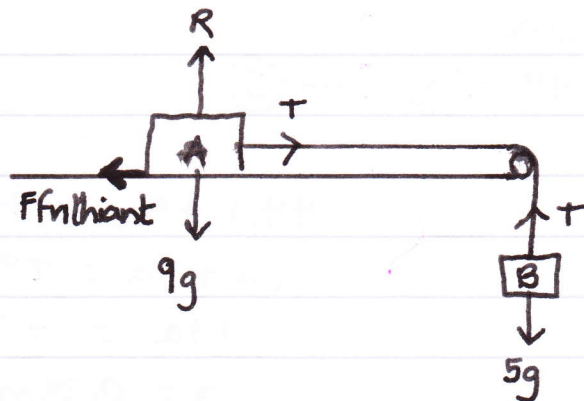


Ffrithiant

Graef 2006



(a) System mewn cydbwysedd.

A: Grymoedd i fyny = Grymoedd i lawr

$$R = 9g \quad \text{--- (1)}$$

Grymoedd i'r chwith = Grymoedd i'r dde

$$F_{\text{frithiant}} = T \quad \text{--- (2)}$$

B: Grymoedd i fyny = Grymoedd i lawr

$$T = 5g \quad \text{--- (3)}$$

Gan fod y system mewn cydbwysedd rhaid bod

$$F_{\text{frithiant}} \leq \mu R$$

$$T \leq \mu R$$

Amnewid o (2)

$$5g \leq \mu R$$

Amnewid o (3)

$$5g \leq \mu(9g)$$

Amnewid o (1)

$$5 \leq 9\mu$$

$$\frac{5}{9} \leq \mu$$

$$\mu \geq \frac{5}{9} \quad \checkmark$$

(b) Mae $0.5 < \frac{5}{9} = 0.5$ felly bydd y system yn symud.

$F = ma$ yn A, yn llorweddol, $\rightarrow = +$ i f

$$T - F_{\text{frithiant}} = 9a$$

$$T - \mu R = 9a$$

$$T - 0.5(9g) = 9a$$

$$T - 44.1 = 9a$$

$$T = 9a + 44.1 \quad \text{--- (4)}$$

$F = ma$ yn B, yn fertigol, $\downarrow = +$ if

$$5g - T = 5a$$

$$49 - T = 5a$$

$$-49 + T = 5a$$

$$T = 49 - 5a \quad \text{--- (5)}$$

$$\textcircled{4} = \textcircled{5} \Rightarrow$$

$$44.1 + 9a = 49 - 5a$$

$$5a + 9a = 49 - 44.1$$

$$14a = 4.9$$

$$\underline{a = 0.35 \text{ ms}^{-2}}$$

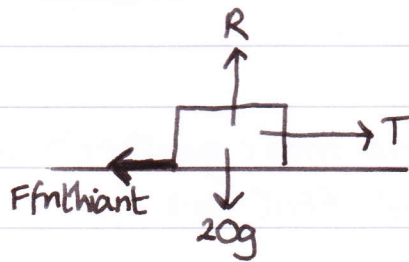
Yn amnewid yn ôl i $\textcircled{4}$: $T = 9a + 44.1$

$$T = 9 \times 0.35 + 44.1$$

$$\underline{T = 47.25 \text{ N}}$$

Haf 2006

3)



$$\mu = 0.3$$

(a) $F = ma$ ar y bocs, yn llorweddol, $\rightarrow = +$ if:
 $T - F_{fntthiant} = 20a$

$$65 - \mu R = 20a$$

$$65 - 0.3(20g) = 20a$$

$$65 - 0.3 \times 20 \times 9.8 = 20a$$

$$6.2 = 20a$$

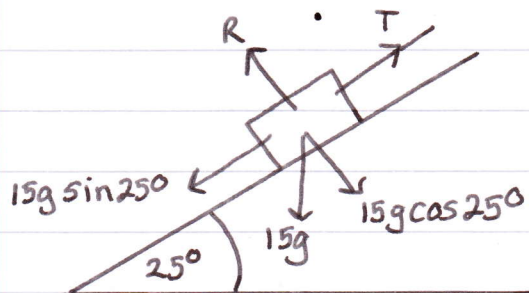
$$a = \frac{6.2}{20}$$

$$a = 0.31 \text{ ms}^{-2}$$

(b) Mae $F_{fntthiant} \leq \mu R$
 $\leq 0.3 \times 20g$
 $\leq 58.8 \text{ N}.$

Felly os yw $T = 45 \text{ N}$ yna mae'r grym ffrithiannol hefyd yn 45 N ac mae'r system mewn cydbwysedd.

9)



$$\mu = 0.4$$

Os ywir tensiwn ar ei leiaf, yna mae'r gwrthrych ar fin symud i lawr y llethr, ac felly mae ffrithiant (ar yderfan μR) yn gweithredu i fyngy'r llethr.

$F = ma$, yn baralel i'r llethr, $\swarrow = +$ if

$$15g \sin 25^\circ - F_{fntthiant} - T = 15a$$

$$15g \sin 25^\circ - \mu R - T = 15a$$

$$15g \sin 25^\circ - (0.4) 15g \cos 25^\circ - T = 15a$$

$$15g \sin 25^\circ - (0.4) 15g \cos 25^\circ - T = 15 \times 0$$

$$15g \sin 25^\circ - (0.4)15g \cos 25^\circ = T$$

$$T = 8.83 \text{ N, i 2 le degol.}$$

Os yw'r tensiwn ar ei fwyaf, yna mae'r gwrthrych ar fin symud i fyny'r llethr, ac felly mae'r ffriithiant (ar y derfan μR) yn gweithredu i lawr y llethr.

$F = ma$, yn baralel i'r llethr, $\nearrow = +$ i f:

$$T - 15g \sin 25^\circ - \text{Ffriithiant} = 15a$$

$$T - 15g \sin 25^\circ - \mu R = 15a$$

$$T - 15g \sin 25^\circ - (0.4)15g \cos 25^\circ = 15a$$

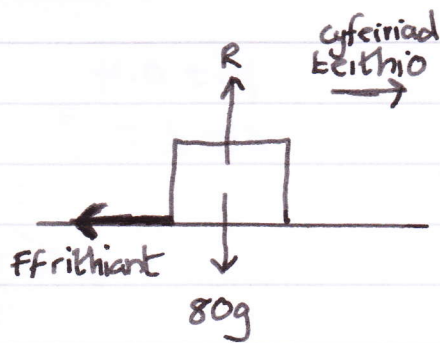
$$T - 15g \sin 25^\circ - (0.4)15g \cos 25^\circ = 15 \times 0$$

$$T = 15g \sin 25^\circ + (0.4)15g \cos 25^\circ$$

$$T = 115.42 \text{ N, i 2 le degol.}$$

Felly, er mwyn cadw'r system mewn cydbwysedd, rhaid i T fod rhwng 8.83 N a 115.42 N .

Gaeaf 2007



$$\begin{aligned} (a) \quad S &= 75\text{m} & v^2 &= u^2 + 2aS \\ u &= 9\text{ms}^{-1} & 0^2 &= 9^2 + 2 \times a \times 75 \\ v &= 0\text{ms}^{-1} & 0 &= 81 + 150a \\ a &= ? & -150a &= 81 \\ t &= ? & a &= \frac{81}{-150} \\ & & a &= \underline{-0.54\text{ms}^{-2}} \end{aligned}$$

$$\begin{aligned} (b) \quad S &= 75\text{m} \\ u &= 9\text{ms}^{-1} \\ v &= 0\text{ms}^{-1} \\ a &= -0.54\text{ms}^{-2} * \\ t &= ? \end{aligned}$$

$$\begin{aligned} S &= \left(\frac{u+v}{2}\right)t \\ 75 &= \left(\frac{9+0}{2}\right)t \\ 75 &= 4.5t \\ t &= \frac{75}{4.5} \\ t &= \underline{16.6\text{s}} \end{aligned}$$

(c) $F = ma$ ar y gwrthrych, yn llorweddol, $\rightarrow = +$ if

$$- \text{ffrithiant} = 80a$$

$$- \mu R = 80 \times -0.54$$

$$- \mu(80g) = -43.2$$

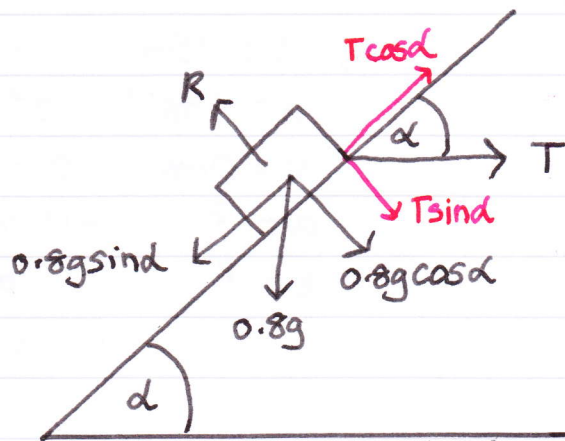
$$- 784\mu = -43.2$$

$$\mu = \frac{-43.2}{-784}$$

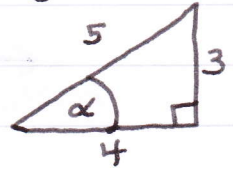
$$\mu = \frac{27}{490}$$

$\mu = 0.055$ yn gywir i 2 ffigur ystyrion.

Haf 2007



$$\mu = 0.4$$
$$\sin \alpha = \frac{3}{5}$$



$$\cos \alpha = \frac{4}{5}$$

Os gwir gwrthrych ar fin symud i fyny'r plân, yna mae ffriithiant yn gweithredu i lawr y plân ac mae'n hafal i'r derfan μR .

$F = ma$ ar y gwrthrych, yn baralel i'r plân, $\uparrow = +$ if:

$$T \cos \alpha - 0.8g \sin \alpha - \text{Ffriithiant} = 0.8a$$

$$T \cos \alpha - 0.8g \sin \alpha - \mu R = 0.8a$$

$$T \cos \alpha - 0.8g \sin \alpha - 0.4R = 0.8 \times 0$$

$$T \cos \alpha - 0.8g \sin \alpha - 0.4(0.8g \cos \alpha + T \sin \alpha) = 0$$

$$T \cos \alpha - 0.8g \sin \alpha - 0.32g \cos \alpha - 0.4T \sin \alpha = 0$$

$$T \cos \alpha - 0.4T \sin \alpha = 0.8g \sin \alpha + 0.32g \cos \alpha$$

$$T(\cos \alpha - 0.4 \sin \alpha) = 0.8g \sin \alpha + 0.32g \cos \alpha$$

$$T\left(\frac{4}{5} - 0.4 \times \frac{3}{5}\right) = 0.8 \times 9.8 \times \frac{3}{5} + 0.32 \times 9.8 \times \frac{4}{5}$$

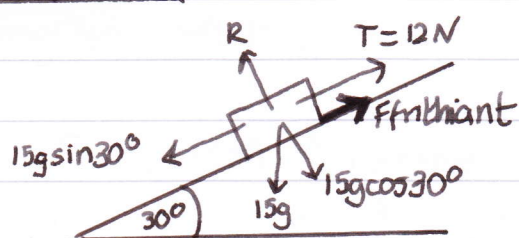
$$\frac{14}{25} T = 7.2128$$

$$T = 7.2128$$

$$\frac{14}{25}$$

$$\underline{T = 12.88 \text{ N}}$$

Graef 2008



$$\mu = 0.2$$

$F = ma$ ar y sled, yn baralel i'r llethr, $\downarrow = +$ if:

$$15g \sin 30^\circ - F_{frithiant} - 12 = 15a$$

$$15g \sin 30^\circ - \mu R - 12 = 15a$$

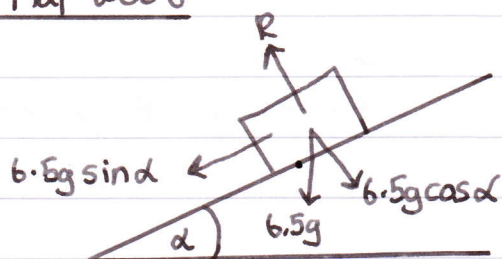
$$15g \sin 30^\circ - 0.2 R - 12 = 15a$$

$$15g \sin 30^\circ - 0.2(15g \cos 30^\circ) - 12 = 15a$$

$$36.03885313 \dots = 15a$$

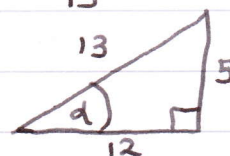
$$\underline{a = 2.4 \text{ ms}^{-2}}, \text{ i un lle degol}$$

Haf 2008



$$\mu = \frac{1}{5}$$

$$\sin \alpha = \frac{5}{13}$$



$$\cos \alpha = \frac{12}{13}$$

- (a) Llithron rhydd i lawr y llethr $\Rightarrow$ Ffrithiant yn gweithredu i fyny'r llethr.
 $F = ma$ ar y gwrthrych, yn baralel i'r llethr, $\downarrow = +$ if.

$$6.5g \sin \alpha - F_{frithiant} = 6.5a$$

$$6.5g \left(\frac{5}{13}\right) - \mu R = 6.5a$$

$$6.5g \left(\frac{5}{13}\right) - \frac{1}{5}(6.5g \cos \alpha) = 6.5a$$

$$6.5g \left(\frac{5}{13}\right) - \frac{1}{5}(6.5g \frac{12}{13}) = 6.5a$$

$$12.74 = 6.5a$$

$$\underline{a = 1.96 \text{ ms}^{-2}}$$

- (b) Yn cael ei dymu i fyny'r llethr ar fuanedd cyson
 $\Rightarrow$ Ffrithiant yn gweithredu i lawr y llethr; cyflymiad = 0 ms^{-2} .

$F = ma$ ar y gwrthrych, yn baradell i'r llethr, $\nearrow = +$ i f:

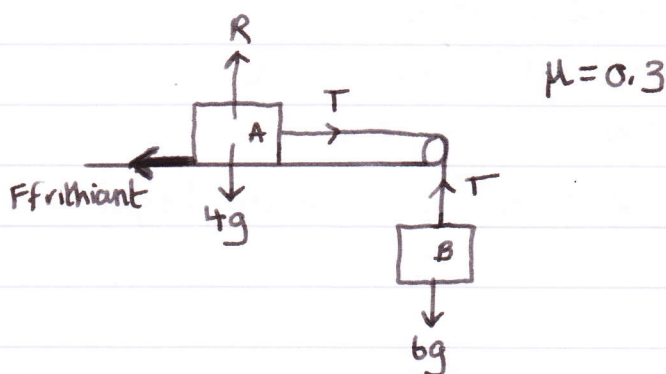
$$T - 6.5g \sin \alpha - F_{\text{frithiant}} = 6.5a$$

$$T - 6.5g \left(\frac{5}{13}\right) - \frac{1}{5} \left(6.5g \frac{12}{13}\right) = 6.5 \times 0$$

$$T = 6.5g \left(\frac{5}{13}\right) + \frac{1}{5} \left(6.5g \frac{12}{13}\right)$$

$$\underline{T = 36.26 \text{ N}}$$

Graef 2009



$F = ma$ yn A, yn llorweddol,
 $\rightarrow = +$ i f:

$$T - F_{\text{frithiant}} = 4a$$

$$T - \mu R = 4a$$

$$T - 0.3 \times 4 \times 9.8 = 4a$$

$$T = 11.76 + 4a$$

$F = ma$ yn B, yn fertigol,
 $\downarrow = +$ i f:

$$6g - T = ba$$

$$58.8 - T = ba$$

$$-58.8 + T = -ba$$

$$T = 58.8 - ba$$

$$11.76 + 4a = 58.8 - ba$$

$$6a + 4a = 58.8 - 11.76$$

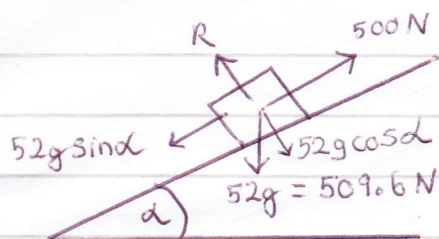
$$10a = 47.04$$

$$\underline{a = 4.704 \text{ ms}^{-2}}$$

Felly $T = 11.76 + 4 \times 4.704$

$$\underline{T = 30.576 \text{ N}}$$

5)



$$\tan \alpha = \frac{5}{12}$$

$$\mu = 0.4$$

$F = ma$ ar y gwrthrych, yn baralel i'r plân, $\nearrow = +$ i f;

$$500 - 52g \sin \alpha - F_{\text{frithiant}} = 52a$$

$$500 - 52 \times 9.8 \times \frac{5}{13} - \mu R = 52a$$

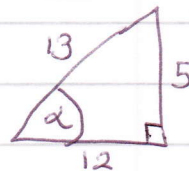
$$500 - 52 \times 9.8 \times \frac{5}{13} - 0.4 \times 52 \times 9.8 \times \frac{12}{13} = 52a$$

$$115.84 = 52a$$

$$a = 2.23 \text{ ms}^{-2} \quad \text{i} \quad 2 \text{ i. d.}$$

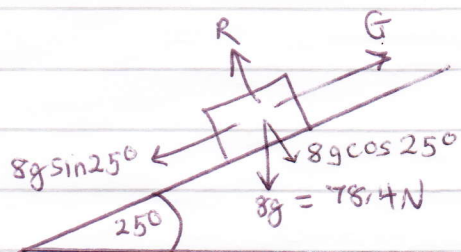
$$\sin \alpha = \frac{5}{13}$$

$$\cos \alpha = \frac{12}{13}$$



Haf 2009

5)



$$\mu = 0.3$$

a) $F = ma$ ar y parcel, yn baralel i'r plân, $\nearrow = +$ i f:

$$G - 8g \sin 25^\circ + F_{\text{frithiant}} = 8a \quad (\text{Ffrithiant i fyny'r plân})$$

$$G - 8 \times 9.8 \times \sin 25^\circ + \mu R = 8a$$

$$G - 8 \times 9.8 \times \sin 25^\circ + 0.3 \times 8 \times 9.8 \times \cos 25^\circ = 8 \times 0$$

$$G = 11.82 \text{ N}, \quad \text{i} \quad 2 \text{ i. d.}$$

b) $F = ma$ ar y parcel, yn baralel i'r plân, $\nearrow = +$ i f

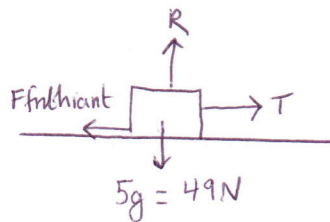
$$G - 8g \sin 25^\circ - F_{\text{frithiant}} = 8a \quad (\text{Ffrithiant i lawr y plân})$$

$$G - 8 \times 9.8 \times \sin 25^\circ - \mu R = 8 \times 0.6$$

$$G - 8 \times 9.8 \times \sin 25^\circ - 0.3 \times 8 \times 9.8 \times \cos 25^\circ = 4.8$$

$$G = 59.25 \text{ N}, \quad \text{i} \quad 2 \text{ i. d.}$$

(6)



$$\mu = 0.6$$

a) $F = ma$ ar y gwrthrych, $\rightarrow = +$ if:

$$T - F_{\text{frithiant}} = 5a$$

$$40 - \mu R = 5a$$

$$40 - 0.6 \times 49 = 5a$$

$$10.6 = 5a$$

$$a = 2.12 \text{ ms}^{-2}$$

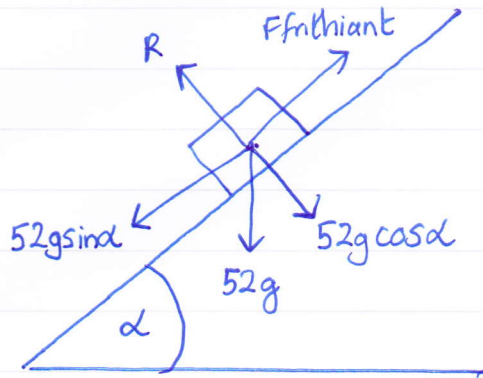
(Y grym ffurthiannol yw 29.4N)

b) Os yw $T = 20$, mae'r gwrthrych yn llonydd ($a = 0 \text{ ms}^{-2}$)
gan fod T yn llai na 29.4N, y grym ffurthiannol mae'n maximum.

Gaeaf 2010

Half 2010

③



$$\sin \alpha = \frac{5}{13}$$

$$\mu = 0.2$$

$$\sqrt{13^2 - 5^2} = \sqrt{144}$$

$$= 12$$

$$\cos \alpha = \frac{12}{13}$$

$F = ma$ ar y bachgen a'r sled, yn baralel i'r llethr.
($\swarrow = +$ if)

$$52g \sin \alpha - F_{fric} = 52a$$

$$52 \times 9.8 \times \frac{5}{13} - \mu R = 52a$$

$$196 - 0.2 \times (52g \cos \alpha) = 52a$$

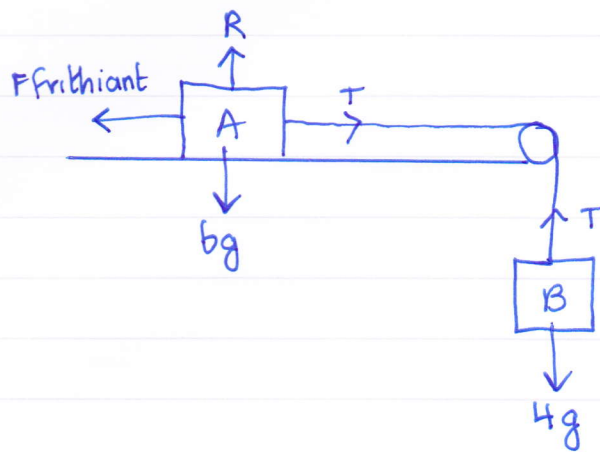
$$196 - 0.2 \times 52 \times 9.8 \times \frac{12}{13} = 52a$$

$$196 - 94.08 = 52a$$

$$101.92 = 52a$$

$$\underline{\underline{a = 1.96 \text{ ms}^{-2}}}$$

5



$$\mu = 0.4$$

a) $F = ma$ ar A ($\rightarrow = +$ if) $F = ma$ ar B ($\downarrow = +$ if)

$$T - F_{\text{frithiant}} = 6a$$

$$T - \mu R = 6a$$

$$T - 0.4 \times bg = 6a$$

$$T - 23.52 = 6a$$

$$T = 6a + 23.52$$

$$4g - T = 4a$$

$$39.2 - T = 4a$$

$$39.2 - 4a = T$$

$$6a + 23.52 = 39.2 - 4a$$

$$10a = 39.2 - 23.52$$

$$10a = 15.68$$

$$\underline{a = 1.568 \text{ ms}^{-2}}$$

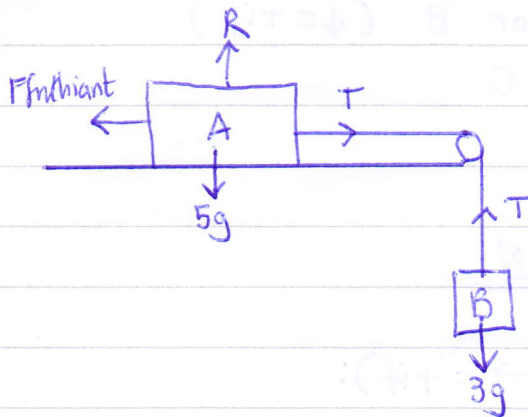
$$\text{Felly } T = 6(1.568) + 23.52$$

$$\underline{T = 32.928 \text{ N}}$$

- b) Maer gair ysgafn yn ein galluogi i gymryd fod mas y llinyn yn sero, felly gallwn ddefnyddio mas y gwrthrychau fel m yn yr hafaliad $F = ma$ heb orfod poeni am fas y llinyn.

Graef 2011

⑥



(a) $\mu = 0.4$

$$\begin{aligned} F_{\text{frthiant}} &= \mu R \\ &= 0.4 \times 5g \\ &= 19.6 \text{ N} \end{aligned}$$

$F = ma$ ar A ($\rightarrow = +$ if):

$$T - F_{\text{frthiant}} = 5a$$

$$T - 19.6 = 5a$$

$$T = 5a + 19.6 \quad \text{--- (1)}$$

$F = ma$ ar B ($\downarrow = +$ if):

$$3g - T = 3a$$

$$-3g + T = -3a$$

$$T = 3g - 3a \quad \text{--- (2)}$$

$$\textcircled{1} = \textcircled{2} : \quad 5a + 19.6 = 3g - 3a$$

$$8a = 3g - 19.6$$

$$8a = 9.8$$

$$\underline{a = 1.225 \text{ ms}^{-2}}$$

Felly $T = 5 \times 1.225 + 19.6$

$$\underline{T = 25.725 \text{ N}}$$

(yn amnewid yn ôl : (1))

(b) Os yw'r gwrthrychau'n parhau yn ddisymud, yna gan ddefnyddio $F=ma$ ar B ($\downarrow = +$ if)

$$3g - T = 3 \times 0$$

$$3g - T = 0$$

$$T = 3g$$

$$\underline{T = 29.4 \text{ N}}$$

Yna $F=ma$ ar A ($\rightarrow = +$ if):

$$T - F_{\text{frithiant}} = 5 \times 0$$

$$T = F_{\text{frithiant}}$$

$$29.4 = F_{\text{frithiant}}$$

$$29.4 = \mu R$$

$$29.4 = \mu \times 5g$$

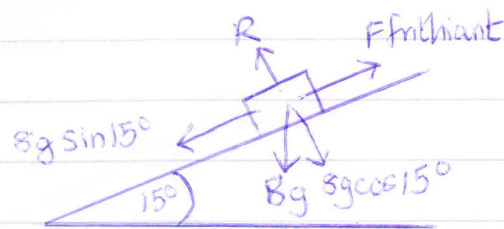
$$29.4 = 49\mu$$

$$\underline{\mu = 0.6}$$

O.b yw'r gwerth lleiaf allai μ fod er mwyn bod y gwrthrychau'n parhau'n ddisymud (gan gefio bod $f_{\text{frithiant}} \leq \mu R$)

11af 11

b)



(a) $F = ma$, yn baralel i'r plân (i lawr y plân yn bositif)

$$8g \sin 15^\circ - F_{frithiant} = 8a$$

$$20.29141314 - F_{frithiant} = 8a$$

$$20.29141314 - F_{frithiant} = 0$$

(gwirhrych yn ddisymud)

$$20.29141314 = F_{frithiant}$$

Ond mae $F_{frithiant} \leq \mu R$

$$F_{frithiant} \leq \mu (8g \cos 15^\circ)$$

$$F_{frithiant} \leq 75.72858478 \mu$$

Er mwyn rhoi 20.29141314 N o $F_{frithiant}$, rhaid bod μ yn fwy na neu'n hafal i weth arbennig:

$$20.29141314 \leq 75.72858478 \mu$$

$$0.2679491925 \leq \mu$$

$$\mu \geq 0.2679491925$$

I ddolau le degol, $\mu \geq 0.27$ (Y gwerth lleiaf yw 0.27)

(b) ($\mu = 0.1$)

$F = ma$, yn baralel i'r plân (i lawr y plân yn bositif)

$$8g \sin 15^\circ - F_{frithiant} = 8a$$

$$8g \sin 15^\circ - \mu R = 8a$$

$$20.29141314 - 0.1 \times 75.72858478 = 8a$$

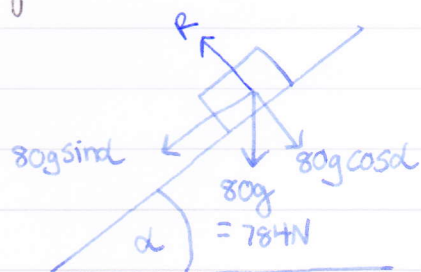
$$12.71855466 = 8a$$

$$a = 1.589819333$$

$$\underline{a = 1.59 \text{ ms}^{-2}} \text{ i ddolau le degol.}$$

Grŵeaf 12

3)



$$\sin \alpha = \frac{3}{5}$$

$$\text{Felly } \cos \alpha = \frac{4}{5}$$



(a) $R = 80g \cos \alpha$ ($F = ma$ yn berpendicwlar i'r plân).

$$R = 80 \times 9.8 \times \frac{4}{5}$$

$$R = \underline{\underline{627.2 \text{ N}}}$$

(b) Ar fin lliethro i lawr y plân $\Rightarrow$ mae grym ffrithiannol μR yn gweithredu i fyny'r plân, ac yn cydbwysu $80g \sin \alpha$.

Felly $80g \sin \alpha = \mu R$

$$80 \times 9.8 \times \frac{3}{5} = \mu \times 627.2$$

$$470.4 = 627.2 \mu$$

$$\mu = \underline{\underline{0.75}}$$

(c) $F = ma$ yn baratei'r plân (i fyny'r plân yn basitif)

$$G - 80g \sin \alpha - \mu R = 80 \times 0.7$$

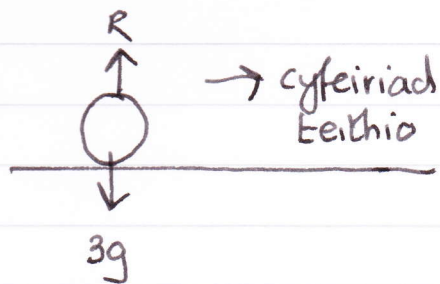
$$G - 80 \times 9.8 \times \frac{3}{5} - 0.75 \times 627.2 = 56$$

$$G - 470.4 - 470.4 = 56$$

$$G = \underline{\underline{996.8 \text{ N}}}$$

M1 Haf 2012

②



$$\mu = \frac{6}{49}$$

(a) $F = ma$ ar y gronyn, yn fertigol: ($\uparrow = +$ if)

$$R - 3g = 3 \times 0$$

$$R = 3g$$

$$R = 29.4 \text{ N}$$

Mae'r gronyn yn symud felly $F_{\text{frithiant}} = \mu R$

$$= \frac{6}{49} \times 29.4$$

$$= \underline{\underline{3.6 \text{ N}}}$$

$F = ma$ ar y gronyn, yn llorweddol ($\rightarrow = +$ if)

$$-3.6 = 3a$$

$$a = -3.6 \div 3$$

$$a = -1.2 \text{ ms}^{-2}$$

Felly arafiad y gronyn yw 1.2 ms^{-2}

(b) Ystyried y mudiant o O i A:

$$S = ?$$

$$u = 9 \text{ ms}^{-1}$$

$$v = 0 \text{ ms}^{-1}$$

$$a = -1.2 \text{ ms}^{-2}$$

$$t = ?$$

$$v^2 = u^2 + 2aS$$

$$0^2 = 9^2 + 2 \times -1.2 \times S$$

$$0 = 81 - 2.4S$$

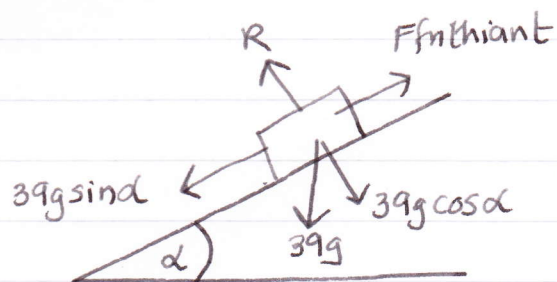
$$2.4S = 81$$

$$S = 81 \div 2.4$$

$$S = \underline{\underline{33.75 \text{ m}}}$$

M1 1taf 2012

(5)



$$\tan \alpha = \frac{5}{12}$$

$$\mu = 0.3$$

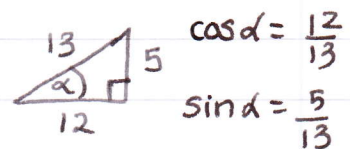
(a) $F = ma$, yn berpendicwlar i'r plân ($\uparrow = +$ if)

$$R - 39g \cos \alpha = 39 \times 0$$

$$R = 39 \times 9.8 \times \cos \alpha$$

$$R = 39 \times 9.8 \times \frac{12}{13}$$

$$R = 352.8 \text{ N}$$



$F = ma$, yn baralel i'r plân ($\leftarrow = +$ if)

$$39g \sin \alpha - F_{frthiant} = 39a$$

$$39 \times 9.8 \times \frac{5}{13} - \mu R = 39a$$

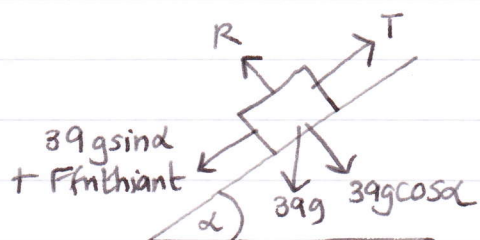
$$147 - 0.3 \times 352.8 = 39a$$

$$41.16 = 39a$$

$$a = 41.16 \div 39$$

$$\underline{a = 1.06 \text{ ms}^{-2}}, \text{ yn gywir i 2 le degol.}$$

(b)



$$a = 0.4 \text{ ms}^{-2}$$

$$\tan \alpha = \frac{5}{12}$$

$$\mu = 0.3$$

$F = ma$, yn baralel i'r plân ($\uparrow = +$ if)

$$T - 39g \sin \alpha - F_{frthiant} = 39 \times 0.4$$

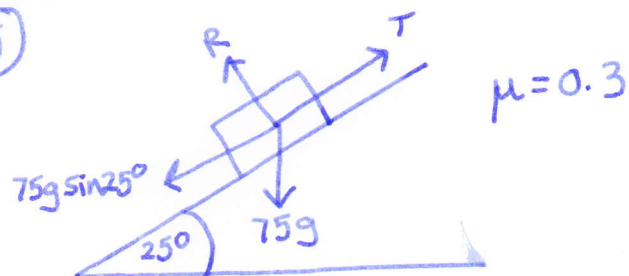
$$T - 39 \times 9.8 \times \frac{5}{13} - \mu R = 15.6$$

$$T - 147 - 0.3 \times 352.8 = 15.6$$

$$T = 15.6 + 147 + 105.84$$

$$\underline{\underline{T = 268.44 \text{ N}}}$$

5



(a) Os yw'r gwrthrych ar fin llythro i lawr y plân, yna mae ffrithiant yn gweithredu i fyny'r plân.

Yn defnyddio $F=ma$, yn barael i'r plân, ($\nearrow = +$ i f)

$$T + \text{Ffrithiant} - 75g \sin 25^\circ = 75a$$

$$T + \mu R - 75g \sin 25^\circ = 75 \times 0$$

(gwrthrych yn llonydd)

$$T + 0.3(75g \cos 25^\circ) - 75g \sin 25^\circ = 0$$

$$T = 75g \sin 25^\circ - 0.3(75g \cos 25^\circ)$$

$$T = 110.7835553 \text{ N}$$

$$T = 110.78 \text{ N i ddau le degol}$$

(b) Os yw $T = 0$ yna mae ffrithiant eto yn gweithredu i fyny'r plân gan fydd y gwrthrych yn symud i lawr y plân.

Yn defnyddio $F=ma$, yn barael i'r plân ($\nearrow = +$ i f)

$$\text{Ffrithiant} - 75g \sin 25^\circ = 75a$$

$$\mu R - 75g \sin 25^\circ = 75a$$

$$0.3(75g \cos 25^\circ) - 75g \sin 25^\circ = 75a$$

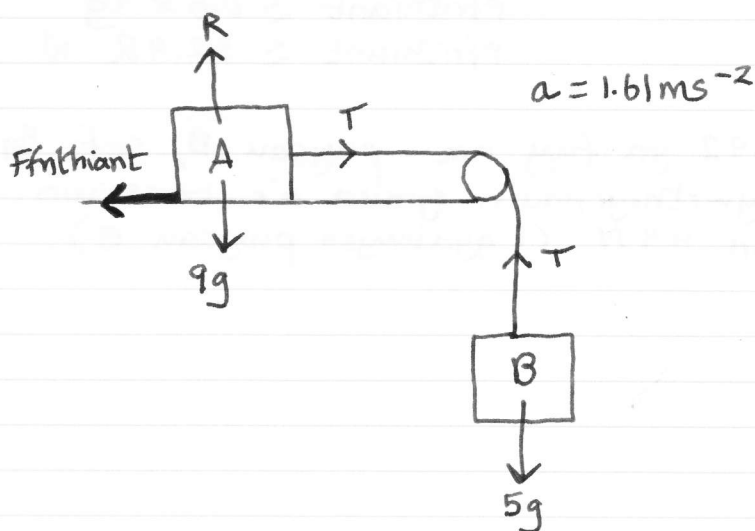
$$0.3(g \cos 25^\circ) - g \sin 25^\circ = a$$

$$a = -1.477114071$$

$$a = -1.48 \text{ ms}^{-2} \text{ i ddau le degol}$$

(cyflymiad i lawr y llethr.)

4)



a) $F = ma$ ar B, yn fertigol, $\downarrow = +$ if

$$5g - T = 5a$$

$$5 \times 9.8 - T = 5 \times 1.61$$

$$49 - T = 8.05$$

$$49 - 8.05 = T$$

$$\underline{T = 40.95 \text{ N}}$$

$F = ma$ ar A, yn llorweddol, $\rightarrow = +$ if

$$T - F_{frithiant} = 9a$$

$$40.95 - F_{frithiant} = 9 \times 1.61$$

$$40.95 - F_{frithiant} = 14.49$$

$$40.95 - 14.49 = F_{frithiant}$$

$$F_{frithiant} = 26.46$$

ond $F_{frithiant} = \mu R$ os gwir gwrthrych yn symud,
a $R = 9g$.

Felly $F_{frithiant} = 26.46$

$$\mu R = 26.46$$

$$\mu(9g) = 26.46$$

$$\mu = \frac{26.46}{9g}$$

$$9g$$

$$\mu = \frac{26.46}{9 \times 9.8}$$

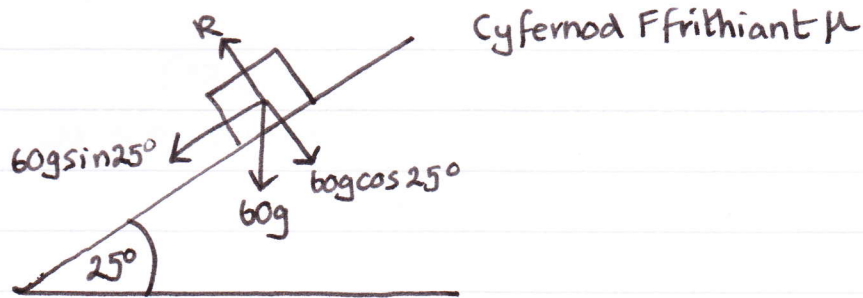
$$\underline{\mu = 0.3}$$

b) Os yw $\mu = 0.6$ yna $\text{Ffrithiant} \leq \mu R$
 $\text{Ffrithiant} \leq 0.6 \times 9g$
 $\text{Ffrithiant} \leq 52.92 \text{ N}$

Gan fod 52.92 yn fwy na pwysau B, sef $5g = 49 \text{ N}$,
ni fydd y gwrthrychau'n symud a'r tensiwn yn
y llinyn fydd 49 N (i gydbwysu pwysau B).

M1 Graef 2014

④



a) $\mu = 0.3$. Llithro i lawr y plân. Ffrithiant i fyny'r plân.

$F = ma$ ar y gwrthrych, yn baralel i'r plân, $\leftarrow = +$ i f.

$$60g \sin 25^\circ - F_{\text{frithiant}} = 60a$$

i) $F_{\text{frithiant}} = \mu R$

$$= 0.3 \times (60g \cos 25^\circ)$$

$$= 0.3 \times 60 \times 9.8 \times \cos 25^\circ$$

$$= \underline{159.8726936 \text{ N}}$$

ii) Yn ôl yn $F = ma$:

$$60 \times 9.8 \times \sin 25^\circ - 159.8726936 = 60a$$

$$248.4995379 - 159.8726936 = 60a$$

$$88.6268443 = 60a$$

$$a = 88.6268443 \div 60$$

$$a = 1.477114072$$

$$\underline{a = 1.48 \text{ ms}^{-2}} \text{ ; 2 le degol}$$

b) Os yw'r gwrthrych yn ddisymud yna $a = 0$.

Yn defnyddio $F = ma$ eto (fel yn (a))

$$60g \sin 25^\circ - F_{\text{frithiant}} = 60a$$

$$248.4995379 - F_{\text{frithiant}} = 60 \times 0$$

$$248.4995379 - F_{\text{frithiant}} = 0$$

$$248.4995379 = F_{\text{frithiant}}.$$

Ond, os yw'r gwrthrych yn ddisymud, mae

$$F \sin \theta = \mu R$$

$$248.4995379 \leq \mu (60g \cos 25^\circ)$$

$$248.4995379 \leq 532.9089788 \mu$$

$$\frac{248.4995379}{532.9089788} \leq \mu$$

$$0.4663076581$$

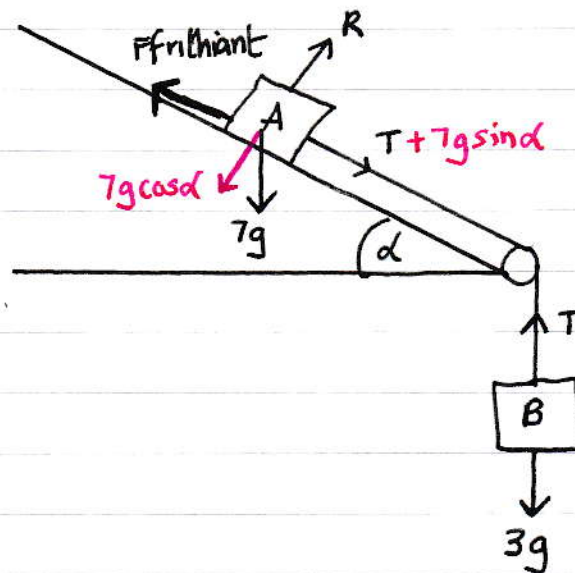
$$0.4663076581 \leq \mu$$

$$\mu \geq 0.4663076581$$

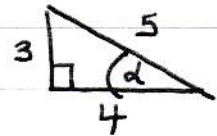
Felly, i 2 le degol, y gwerth lleiaf posib
ar gyfer μ yw $\mu = 0.47$

M1 Haf 2014

③



$$\mu = 0.6$$
$$\tan \alpha = \frac{3}{4}$$



$$\sin \alpha = \frac{3}{5}$$
$$\cos \alpha = \frac{4}{5}$$

(a) $F = ma$ ar A, yn berpendicwlar i'r plân, $\uparrow = +$ if

$$R - 7g \cos \alpha = 7a$$

$$R - 7g \cos \alpha = 7 \times 0$$

$$R = 7g \cos \alpha$$

$$R = 7 \times 9.8 \times \frac{4}{5}$$

$$\underline{R = 54.88 \text{ N}}$$

Gan fod A yn symud i lawr y llethr

$$F_{\text{frithiant}} = \mu R$$

$$= 0.6 \times 54.88$$

$$= \underline{\underline{32.928 \text{ N}}}$$

(b) $F = ma$ ar A, yn baralel i'r plân, $\rightarrow = +$ if

$$T + 7g \sin \alpha - F_{\text{frithiant}} = 7a$$

$$T + 7 \times 9.8 \times \frac{3}{5} - 32.928 = 7a$$

$$T + 41.16 - 32.928 = 7a$$

$$T + 8.232 = 7a$$

$$T = 7a - 8.232$$

①

$F = ma$ ar B, yn fertigol, $\downarrow = +$ if

$$3g - T = 3a$$

$$3 \times 9.8 - T = 3a$$

$$29.4 - 3a = T \quad \text{--- (2)}$$

Mae (1) a (2) yn awgrymu bod

$$7a - 8.232 = 29.4 - 3a$$

$$7a + 3a = 29.4 + 8.232$$

$$10a = 37.632$$

$$\underline{\underline{a = 3.7632 \text{ ms}^{-2}}}$$

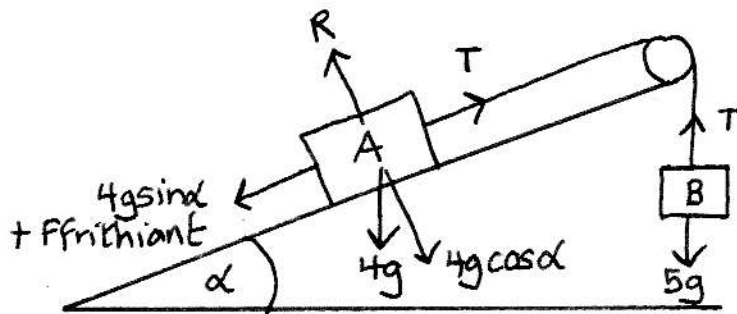
Yn amnewid am a yn ôl i (2):

$$T = 29.4 - 3 \times 3.7632$$

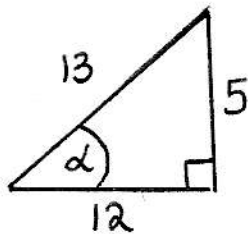
$$\underline{\underline{T = 18.1104 \text{ N}}}$$

M1 Haf 2015

2)



$$\sin \alpha = \frac{5}{13}$$



$$\sin \alpha = \frac{5}{13}$$

$$\cos \alpha = \frac{12}{13}$$

$F = ma$ ar B, yn fertigol, $\downarrow = +$ if

$$5g - T = 5a$$

$$5 \times 9.8 - T = 5 \times 0 \quad (\text{mewn cydbwysedd})$$

$$49 - T = 0$$

$$49 = T$$

$$\underline{T = 49 \text{ N}}$$

$F = ma$ ar A, yn berpendicwlar i'r plân, $\nwarrow = +$ if

$$R - 4g \cos \alpha = 4a$$

$$R - 4 \times 9.8 \times \frac{12}{13} = 4 \times 0 \quad (\text{mewn cydbwysedd})$$

$$R - \frac{2352}{13} = 0$$

$$R = \frac{2352}{13} \text{ N}$$

$F = ma$ ar A, yn baralel i'r plân, $\nearrow = +$ if

$$T - 4g \sin \alpha - F_{\text{frithiant}} = 4a$$

$$49 - 4 \times 9.8 \times \frac{5}{13} - \mu R = 4 \times 0 \quad (\text{mewn cydbwysedd, ar fin symud i fyny'r plân})$$

$$49 - \frac{196}{13} - \mu \left(\frac{2352}{13} \right) = 0$$

$$\frac{441}{13} = \frac{2352}{13} \mu$$

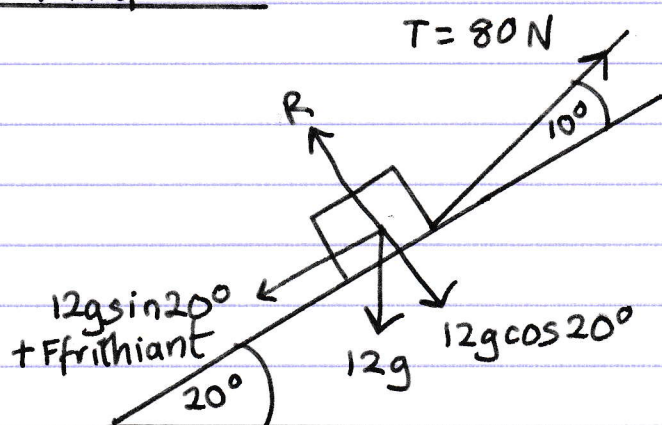
$$\mu = \frac{441 \times 13}{2352}$$

$$\mu = \frac{15}{16}$$

QED

MI Haf 2016

⑦



$$\mu = 0.2$$

- a) Yn ystyried y grymoedd yn berpendicwlar i'r plân:

$$12g \cos 20^\circ = R + 80 \sin 10^\circ$$

$$R = 12g \cos 20^\circ - 80 \sin 10^\circ$$

Y grym ffrithiannol yw MR

$$= 0.2 (12g \cos 20^\circ - 80 \sin 10^\circ)$$

$$= 19.3231996$$

$$= \underline{19.32 \text{ N}} \text{ i 2 le degol}$$

- b) $F = ma$ yn baralel i'r plân, $\nearrow = +$ i f

$$80 \cos 10^\circ - 12g \sin 20^\circ - F_{\text{frithiant}} = 12a$$

$$80 \cos 10^\circ - 12g \sin 20^\circ - 0.2(12g \cos 20^\circ - 80 \sin 10^\circ) = 12a$$

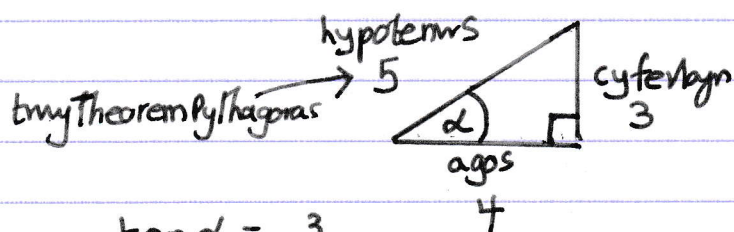
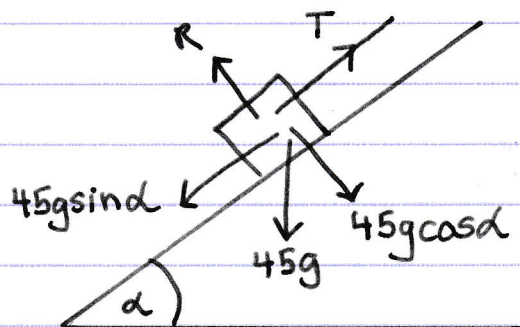
$$a = \frac{80 \cos 10^\circ - 12 \times 9.8 \times \sin 20^\circ - 0.2(12 \times 9.8 \times \cos 20^\circ - 80 \sin 10^\circ)}{12}$$

$$a = 1.603320982$$

$$a = \underline{1.60 \text{ ms}^{-2}} \text{ i 2 le degol}$$

MI Haf 2017

7)



$$\tan \alpha = \frac{3}{4}$$

$$\mu = 0.5$$

$$\sin \alpha = \frac{3}{5}$$

$$\cos \alpha = \frac{4}{5}$$

Os yw'r tensiwn ar ei leiaf, mae'r gwrthrych ar fin symud i lawr y llethr, ac felly mae ffriithiant (ar y derfan μR) yn gweithredu i fyngy'r llethr.

$F = ma$, yn baralel i'r llethr, $\downarrow = +$ if

$$45g \sin \alpha - \text{Ffriithiant} - T = 45a$$

$$45 \times 9.8 \times \frac{3}{5} - \mu R - T = 45a$$

$$264.6 - 0.5(45g \cos \alpha) - T = 45 \times 0$$

$$264.6 - 0.5 \times 45 \times 9.8 \times \frac{4}{5} - T = 0$$

$$264.6 - 176.4 = T$$

$$\underline{T = 88.2 \text{ N}} \quad \leftarrow \text{gwerth lleiaf posib y tensiwn}$$

Os yw'r tensiwn ar ei fwyaaf, mae'r gwrthrych ar fin symud i fyngy'r llethr, ac felly mae ffriithiant (ar y derfan μR) yn gweithredu i lawr y llethr.

$F = ma$, yn baralel i'r llethr, $\uparrow = +$ if

$$T - 45g \sin \alpha - \text{Ffriithiant} = 45a$$

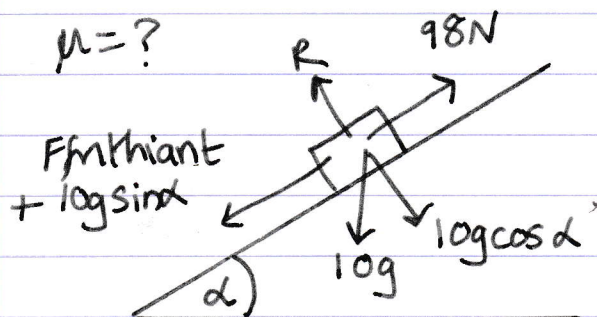
$$T - 264.6 - \mu R = 45 \times 0$$

$$T - 264.6 - 176.4 = 0$$

$$\underline{T = 441 \text{ N}} \quad \leftarrow \text{gwerth mwyaf posib y tensiwn.}$$

M1 Haf 2018

8) $\mu = ?$



Mae'r gwrthrych ar fin symud i fyny'r llethr, felly mae ffrithiant i lawr y llethr.

$F = ma$, yn baralel i'r llethr, $\nearrow = +$ i f.

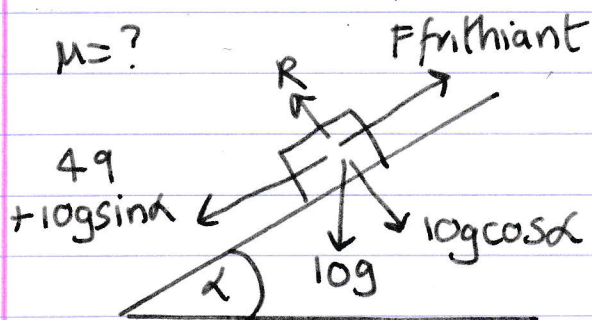
$$98 - F_{frithiant} - 10g \sin \alpha = 10a$$

$$98 - \mu R - 10g \sin \alpha = 10 \times 0$$

$$98 - \mu (10g \cos \alpha) - 10g \sin \alpha = 0$$

$$98 = 10g \sin \alpha + 10g \mu \cos \alpha \quad \text{--- (1)}$$

$\mu = ?$



Mae'r gwrthrych ar fin symud i lawr y llethr, felly mae ffrithiant i fyny'r llethr.

$F = ma$, yn baralel i'r llethr, $\nearrow = +$ i f

$$F_{frithiant} - 49 - 10g \sin \alpha = 10a$$

$$\mu R - 49 - 10g \sin \alpha = 10 \times 0$$

$$\mu (10g \cos \alpha) - 49 - 10g \sin \alpha = 0$$

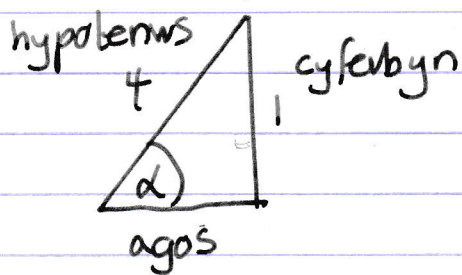
$$10g \mu \cos \alpha = 49 + 10g \sin \alpha$$

Yn amnewid am $10g \mu \cos \alpha$ i mewn i (1):

$$98 = 10g \sin \alpha + (49 + 10g \sin \alpha)$$

$$49 = 20g \sin \alpha$$

$$\frac{49}{20g} = \sin \alpha, \quad \underline{\underline{\sin \alpha = \frac{1}{4}}}$$



Theorem Pythagoras:

$$\begin{aligned} \text{agos} &= \sqrt{4^2 - 1^2} \\ &= \sqrt{15} \end{aligned}$$

$$\text{Felly } \cos \alpha = \frac{\text{agos}}{\text{hypotenws}}$$

$$\cos \alpha = \frac{\sqrt{15}}{4}$$

Yn ôl yn (1):

$$98 = 10g \sin \alpha + 10g \mu \cos \alpha$$

$$98 = 10 \times 9.8 \times \frac{1}{4} + 10 \times 9.8 \times \mu \times \frac{\sqrt{15}}{4}$$

$$98 = 24.5 + \frac{49\sqrt{15}}{2} \mu$$

$$73.5 = \frac{49\sqrt{15}}{2} \mu$$

$$147 = 49\sqrt{15} \mu$$

$$3 = \sqrt{15} \mu$$

$$\frac{3}{\sqrt{15}} = \mu$$

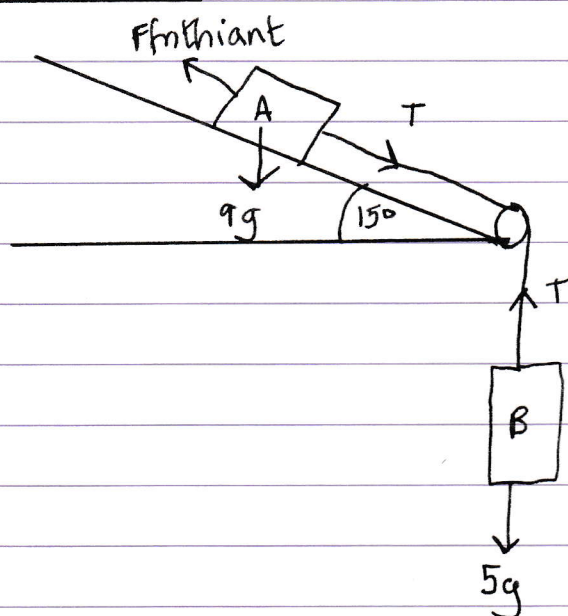
$$\mu = \frac{3}{\sqrt{15}} \times \frac{\sqrt{15}}{\sqrt{15}}$$

$$\mu = \frac{3\sqrt{15}}{15}$$

$$\mu = \frac{\sqrt{15}}{5}$$

MI Haf 2019

6)



Cyfernod ffriithiant μ

a) $\mu = 0$

$F = ma$ ar A, ar hyd y llethr, $\downarrow = +$ if

$$T + 9g \sin 15^\circ - F_{\text{frithiant}} = ma$$

$$T + 9g \sin 15^\circ - \mu R = 9a$$

$$T + 9g \sin 15^\circ - (0)R = 9a$$

$$T = 9a - 9g \sin 15^\circ \quad \text{--- (1)}$$

$F = ma$ ar B, yn fertigol, $\downarrow = +$ if

$$5g - T = 5a$$

$$5g - 5a = T \quad \text{--- (2)}$$

$$\textcircled{1}, \textcircled{2} \Rightarrow 9a - 9g \sin 15^\circ = 5g - 5a$$

$$14a = 5g + 9g \sin 15^\circ$$

$$a = \frac{5g + 9g \sin 15^\circ}{14}$$

$$a = 5.130559984$$

$$\underline{a = 5.13 \text{ ms}^{-2}} \quad ; 2 \text{ le degol.}$$

Amnewid yn ôl yn $\textcircled{2}$: $T = 5g - 5 \times 5.130559984$

$$\underline{T = 23.35 \text{ N}} \quad ; 2 \text{ le degol}$$

b) $a = 0 \text{ ms}^{-2}$

$F = ma$ ar A, ar hyd y llethr, $\downarrow = +$ if

$$T + 9g \sin 15^\circ - F_{\text{frithiant}} = ma$$

$$T + 9g \sin 15^\circ - F_{\text{frithiant}} = 9 \times 0$$

$$T + 9g \sin 15^\circ = F_{\text{frithiant}} \quad \text{--- (1)}$$

$F = ma$ ar B, yn fertigol, $\downarrow = +$ if

$$5g - T = 5a$$

$$5g - 5a = T$$

Yn amnewid am T yn (1):

$$5g - 5a + 9g \sin 15^\circ = F_{\text{frithiant}}$$

$$5g - 5 \times 0 + 9g \sin 15^\circ = F_{\text{frithiant}}$$

$$F_{\text{frithiant}} = 5g + 9g \sin 15^\circ.$$

Ond hefyd $F_{\text{frithiant}} \leq \mu R$

$$5g + 9g \sin 15^\circ \leq \mu (9g \cos 15^\circ)$$

$$\frac{5g + 9g \sin 15^\circ}{9g \cos 15^\circ} \leq \mu$$

$$\mu \geq \frac{5g + 9g \sin 15^\circ}{9g \cos 15^\circ}$$

$$\mu \geq 0.843102626$$

$$\mu \geq 0.84 \text{ i 2 le degol}$$

Gwerth lleiaf posib μ yw 0.84, i 2 le degol