



KURSKOD / COURSE CODE <b>F 0 0 6 0 T</b>	PROV / TEST CODE <b>0 0 0 7</b>
KURSBENÄMNING / COURSE NAME <b>Mekanik och experimentella metoder</b>	
PROVBENÄMNING / TEST NAME <b>Skriftlig tentamen</b>	
TENTAMENSDATUM / EXAMINATION DATE <b>2 0 2 5 - 0 1 - 1 7</b>	
TENTAMENSORT/CITY (för distansstudenter / for off campus students only)	

ÅÅÅÅMMDD-XXXX YYYYMMDD-XXXX	
PERSONNUMMER / PERSONAL NUMBER <b>20040829 - 7133</b>	
NAMN (TEXTA) / FULL NAME <b>Björn Malmgren</b>	
NAMTECKNING / YOUR SIGNATURE <b>Björn Malmgren</b>	
PROGRAM <b>Datorspelsprogrammering</b>	INSKR.ÅR/YEAR <b>2023</b>
ANTAL SIDOR / NO. OF PAGES <b>10</b>	

### Skanningsblad/Scanning Sheet

Behandlat

uppgift nr (sätt x) /

Mark the questions you  
answered with an X

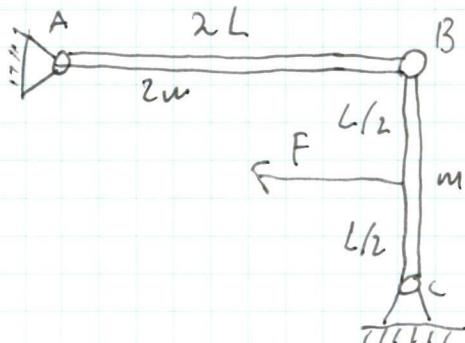
Lärarens anteckningar / Teacher's notes

1	X	0,5	
2	X	0	
3	X	0	
4	X	0,5	
5	X	0	
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
Poängsumma Points	1	Betyg Grade	U

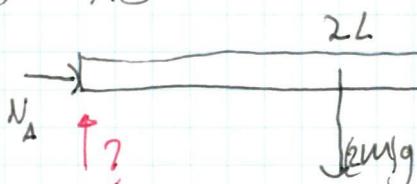
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Tentamensomslag skall alltid inlämnas även om ingen uppgift behandlats  
Examination cover should always be submitted even if no questions are answered





a)  $AB$

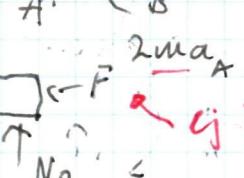


anteckning:

mig horisontell? Varför

$\rightarrow x \left\{ \begin{array}{l} 2mg - N_B = 0 \\ N_A - F = 0 \end{array} \right. ?$

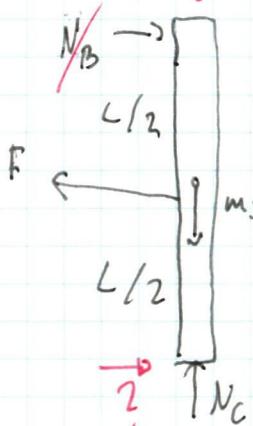
A:  $N_B + 2mg - F \sin \theta = 0$ , hörvarm  
 mta vila



$a_A = a_B$

0,5

BC



$$\begin{aligned} \rightarrow x & \left\{ \begin{array}{l} N_B - F = m_{AB} a \\ N_C - mg = 0 \end{array} \right. \\ \uparrow y & \\ \curvearrowleft z & \left\{ \begin{array}{l} N_B - F + mg \cos \theta = F \cos \theta \\ m_{AB} \text{ anta vila} \end{array} \right. \end{aligned}$$

highly  
vibrant

$$b) N_B = m_{\text{ag}} \quad N_B = m_{\text{ag}} + F$$

? motivem

$$N_A = F + 2m_a B$$

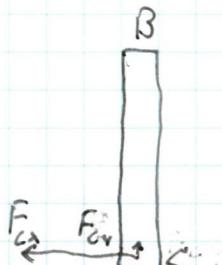
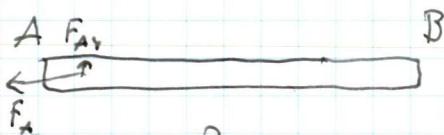
$$N = mg$$

$$2mg = Ma_B + F$$

$$N_B = m_{a_B} + F + F \cos \theta$$

$$- mg \cos \theta$$

$$N_B = 2mg - F \sin \theta - 2m a_t$$



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$$2mg - F \sin \theta - 2m a_A = m a_B + F + F \cos \theta - mg \cos \theta$$

$$a_A = a_B$$

$$F \sin \theta = 3m a_B + F + F \cos \theta - mg \cos \theta - 2mg$$

$$F \sin \theta - F - F \cos \theta = 3m a_B - mg \cos \theta - 2mg$$

$$F(\sin \theta - 1 - \cos \theta) = 3m a_B - mg \cos \theta - 2mg$$

$$F = \frac{3m a_B - mg \cos \theta - 2mg}{\sin \theta - 1 - \cos \theta}$$

$$A \\ F_x = \left( \frac{3m a_B - mg \cos \theta - 2mg}{\sin \theta - 1 - \cos \theta} \right) \cdot -1$$

$$F_y = 0$$

$$C \\ F_x = \frac{3m a_B - mg \cos \theta - 2mg}{\sin \theta - 1 - \cos \theta}$$

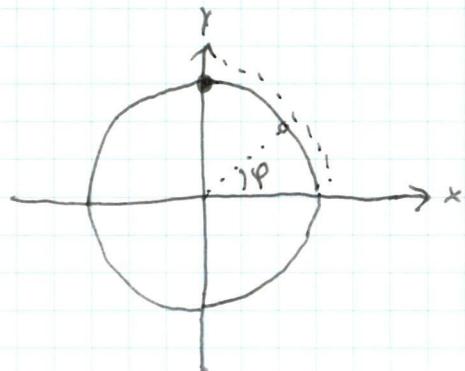
Uppgift nr:

2

Poäng:

0

Lärarens  
anteckning:



$$R = 0,4 \text{ m}$$

Sekunder läge

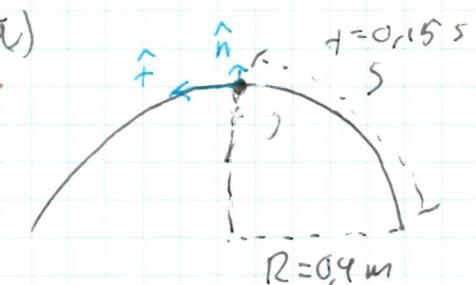
$$O \quad \varphi = 0$$

$$0,15$$

$$\varphi = 90\left(\frac{\pi}{2}\right)$$

Likformig färdighetsläge

a)



$$v = 0,15 \text{ m/s}$$

$$n = 0 \text{ m/s}^2 \quad \checkmark \text{ ej } 0 \text{ vid cirkelrörelse}$$

$$s = r \cdot \varphi$$

$$s = 0,4 \cdot \frac{\pi}{2} \approx 0,6283 \text{ m}$$

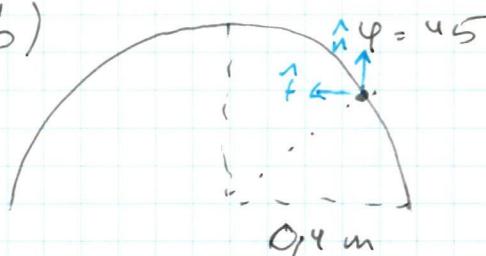
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$$v = \frac{\Delta s}{\Delta t} = \frac{0,62 - 0}{0,15 - 0} \approx 4,1886 \text{ m/s}$$

medelhastighet, inte slut-hastighet!

$$a = \frac{\Delta v}{\Delta t} = \frac{4,1886}{0,5} \approx 27,9 \text{ m/s}^2$$

b)



pga likformig färdighetsläge

är accelerationen konstant

$$a = 27,9$$

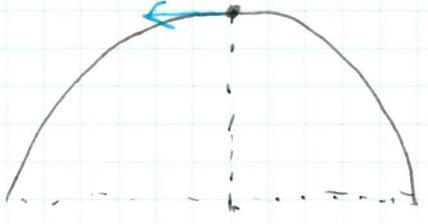
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$$f = 13,95 \text{ m/s}^2$$

pga att i  $45^\circ$  måste

$n = 13,95 \text{ m/s}^2$  kroppen röra sig lika mycket horisontellt o vertikalt blir  $f = n$  båda  $27,9/2$

Det är skillnad på hastighet och acceleration!

		Uppgift nr: 2
Poäng: 		
Lärarens anteckning: 		
c)	$\varphi = 90^\circ$ 	
d)	$\varphi = 90^\circ$ $v = v_0 + at$ $v = 0 + 27,9 \cdot 0,15 = 4,185 \text{ m/s}$	
	$\varphi = 45^\circ$ $v^2 = v_0^2 + 2a(s - s_0)$ $v^2 = 2 \cdot 27,9 \cdot (0,31) = 17,298$ $s = 0,4 \cdot \frac{\pi}{4} = 0,31$	 
	$v = \sqrt{17,298} = 4,159 \text{ m/s}$	

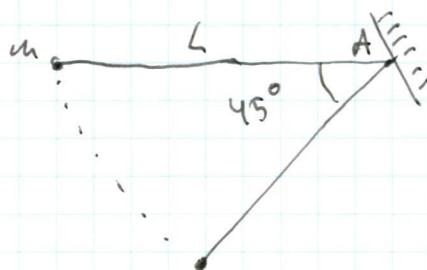
Uppgift nr:

3

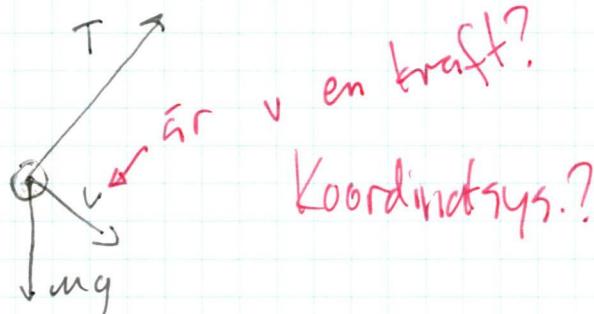
Poäng:

0

Lärarens  
anteckning:



a)



0

b)

$\begin{cases} x \\ y \end{cases}$  kraft?

$$\underline{v \cos \theta + T \cos \theta = ma_x} \quad (1)$$

$$\begin{cases} T \sin \theta - mg = ma_y \\ -mg \end{cases}$$

hövärk?

richtning på a?

Vad är x?

-||-y?

ej definierat

$$v = \frac{ma}{\cos \theta} - T$$

$$T = \frac{mg}{\sin \theta} + \frac{ma}{\sin \theta}$$

$$v = \frac{ma}{\cos \theta} - \frac{mg}{\sin \theta} - \frac{ma}{\sin \theta}$$

massa · acceleration =  
hastighet?

$$= \frac{mas \sin \theta - mac \cos \theta - mg \cos \theta}{\cos \theta \sin \theta}$$

$$= \frac{ma(\sin \theta - \cos \theta) - mg \cos \theta}{\cos \theta - \sin \theta}$$

$$= \frac{mg \cos \frac{\pi}{4}}{\frac{1}{2}} = \frac{m \cdot 9,82 \cdot \cos \frac{\pi}{4}}{2} \text{ m/s}$$

0

Uppgift nr:

3

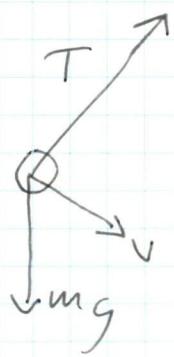
Poäng:

↙

Lärarens  
anteckning:

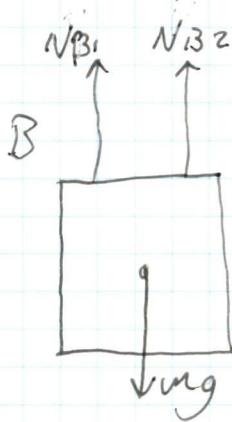
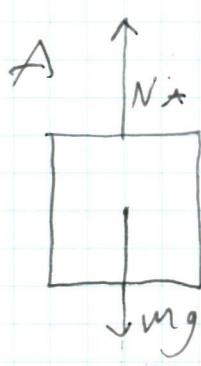
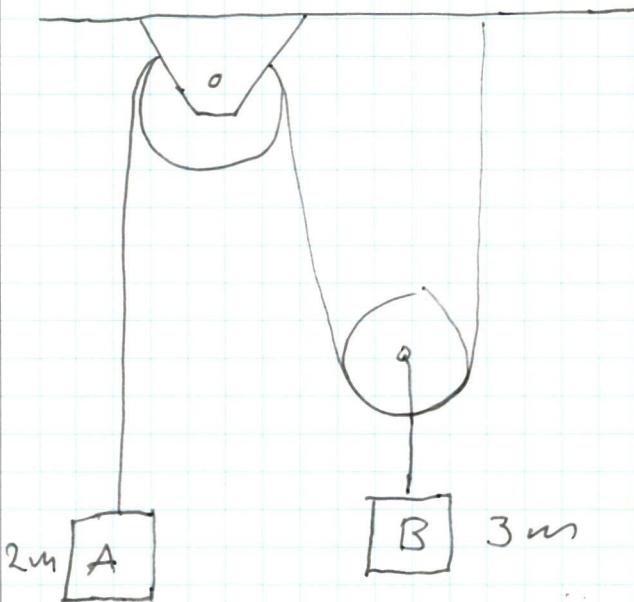
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c)



$$T = L \sin \frac{\pi}{q} - mg \cos \frac{\pi}{q}$$

$$T = L \sin \frac{\pi}{q} + mg \cos \frac{\pi}{q}$$



$$N_A = N_{B1} + N_{B2} \text{ ok}$$

$$N_{B1} = N_{B2} \text{ också}$$

$a_A = a_B$  Nej, de är olika

Olika m!

$$\sum F_y = N_A - mg = ma_B$$

$$\sum F_x = N_{B1} + N_{B2} - mg = ma_B$$

Olika riktn.

$$N_A = ma_A + mg$$

$$N_{B1} + N_{B2} = 3ma_B + 3mg$$

på  $a_A, a_B$ !

$$N_A = 2ma_A + 2mg$$

$$a_A = a_B$$

Aha, här blev det rätt  
massor

$$3ma_B + 3mg = 2ma_A + 2mg \checkmark$$

$$3ma_A + 3mg = 2ma_A + 2mg$$

$$\frac{ma_A}{m} = \frac{-mg}{m}$$

$$a_A = -g$$

$$a_A = -9,82 \text{ m/s}$$

Acceleratönen hos  
kropp A är  $-9,82 \text{ m/s}$

b) kropp A

$$\sum F_y = N_A - 2mg = 2ma_A$$

$$a_A = a_B$$

kropp B

$$N_A = N_{B1} + N_{B2}$$

$$\sum F_y = N_{B1} + N_{B2} - mg = ma_B$$

$$N_A = 2ma_A + 2mg$$

$$N_{B1} + N_{B2} - 3mg = 3ma_B$$

$$3mg = N_{B1} + N_{B2} - 3ma_B$$

$$mg = \frac{N_{B1} + N_{B2} - 3ma_B}{3}$$

$$N_A = 2ma_A + 2\left(\frac{N_{B1} + N_{B2}}{3} - ma_B\right)$$

$$N_A = 2ma_A + \frac{2}{3}N_A - 2ma_B$$

$$N_A = N_A = \frac{3(2ma_B - 2ma_A)}{2} = \frac{6ma_B - 6ma_A}{2} =$$

$$3ma_B - 3ma_A = 0 \text{ N } \checkmark$$

Uppgift nr:

4

Poäng:

4

Lärarens  
anteckning:

Uppgift nr:

5

Poäng:

0

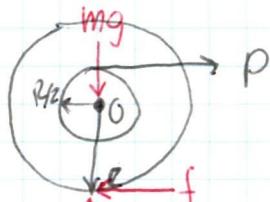
Lärarens  
anteckning:

$$(a) I_z = \frac{1}{2} m \left(\frac{R}{2}\right)^2$$

Inga friktion

massan  $m$ ,  
radien  $R$ , inner radian  $\frac{R}{2}$ 

$$\sum F_x = P + I_z = ma$$



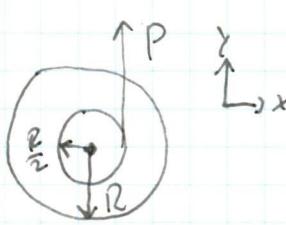
$$a = \frac{P + I_z}{m}$$

$$a = \frac{P + \frac{1}{2} m \left(\frac{R}{2}\right)^2}{m} = \frac{P}{m} + \frac{1}{2} \left(\frac{R}{2}\right)^2$$

$$a = \frac{P}{m} + \frac{1}{2} \left(\frac{R}{m}\right)^2$$

Riktningen blir positiva med avseende

på x-axeln vilket är så trådrollen kommer  
rulla

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		Uppgift nr: <b>5</b>	
		Poäng:	
		Lärarens anteckning:	
b)	$I_z = \frac{1}{2}m\left(\frac{R}{2}\right)^2$ massan $m$ 	radicev $R$ inner radicev $\frac{R}{2}$	
		$\sum F_y = P - mg - I_z = ma$	
	$\underbrace{P - mg + \frac{1}{2}m\left(\frac{R}{2}\right)^2}_{m} = \frac{ma}{m}$		
	$P - mg + \frac{1}{2}\left(\frac{R}{2}\right)^2 = a \quad (=) \quad a = \frac{P}{m} - g + \frac{1}{2}\left(\frac{R}{2}\right)^2$		
	Riktningen blir negativ med avseende L/H här trådrollen kommer rulla		