HT #1

1. 5/5
2. 5/5
3. 7/7

4. 7/7
5. 12/12

Total 36/36

1. $f = 3 + 5t^2$ average from $t=0 \rightarrow t=0.5$

5/5

$$\bar{f} = \frac{\int_0^{0.5} f\,dt}{\int_0^{0.5} dt} \quad (2)$$

(2) $$\int f\,dt = \int (3 + 5t^2)\,dt = \left[3t + \frac{5}{3}t^3\right]\Big|_0^{0.5}$$

$$= 3 \times 0.5 + \frac{5}{3}(0.5)^3 = 1.5 + 0.208$$

$$= 1.708$$

(1) $$\bar{f} = \frac{1.708}{0.5} = \boxed{3.416}$$

if $\bar{f} = \frac{f(0.5) + f(0)}{2}$ 2/5 or $\bar{f} = \frac{f(0.5) - f(0)}{0.5}$ 1/5

if $\int$ ok, but forget to divide by t → −1 4/5

if $\int 3\,dt = 3$ (forget constant $x\,dt = c/x\,t$) −1

if $\int x^2 dx = \frac{1}{2}x^3$ wrong constant −1 4/5

Bonus $f = 3 + e^{-0.015t}$

$$\int f\,dt = \left[3t + \frac{1}{-0.015}e^{-0.015t}\right]\Big|_0^{0.5}$$

+3

$$1.5 + \left(\frac{1}{-0.015}(0.993 - 1) = 0.498\right) = 1.998$$

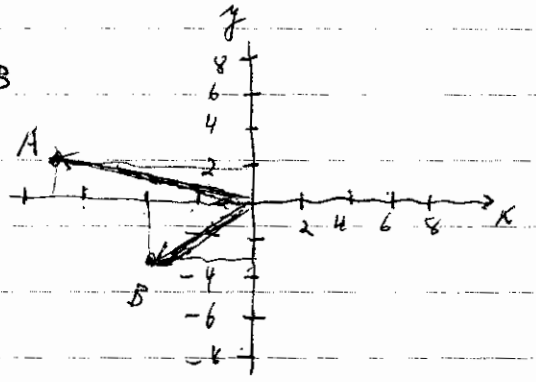
$$\bar{f} = \frac{1.998}{0.5} = 3.996$$

if integral o.k. but not evaluated right +2

2. vectors A & B

5/5

Graph: +3 / +2



	A	B
x	-7	-4
y	2	-3
abs.	7.28	5

Angle: +3

$$\frac{A_x B_x + A_y B_y}{|A||B|} = \cos\theta = \frac{7 \times 4 + 2 \times (-3)}{7.28 \times 5} = \frac{22}{}$$

$$= 0.604$$

$$\theta = a\cos(0.604) = \boxed{52.8^\circ} \text{ or } 0.922 \text{ rad}$$

~~54.1°~~ ~~0.543~~

If Angle = $\theta_B - \theta_A$ 1.5/3

If Angle = without • prod ~~N/A~~ 2/3

If $A_x B_x + A_y B_y = A \cdot B$ is wrong 1.5/3

If $A_x B_x + A_y B_y = \sin\theta\, AB$ ~~WRONG~~ 1.5/3

Tigran Avetisian
Justin Stickman
?

Capelli
Allen

7/7 3. $x = 0.5t - 0.03t^3$

$y = 2\cos(0.2t)$

a) $v_x = \frac{dx}{dt} = 0.5 - 0.09t^2$

4/4 $v_y = \frac{dy}{dt} = -2 \times 0.2 \cdot \sin(0.2t)$

-1 if degrees, not radians.

-2 if derivative $\frac{dx}{dt}$ = wrong

b) when $t = 2$ s

2/2 i) $v_x = 0.140$ m/s

$v_y = -0.156$ m/s if degrees then $v_y = -0.0028$ take off 1 point.

1/2 ii

ii) $t = 0$ $v_x = 0.5$

$v_y = 0$

4. $a_x = -0.18t$

7/7 $a_y = -0.08\cos(0.2t)$

a) $v \overset{(2)}{=} \int_0^t a\,dt$

4/4
5/5 (2) $v_x = \int a_x dt = -0.18\int_0^t t\,dt = -\frac{0.18}{2}t^2$

(1) $v_y = \int_0^t a_y dt = -0.08\int \cos(0.2t)dt = -\frac{0.08}{0.2}\sin(0.2t)$

-0.4

b) when $t = 2\pi$

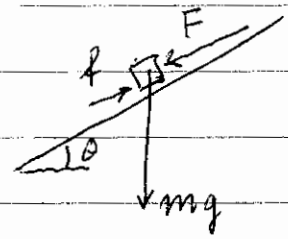
(2) $v_x = -\frac{0.18}{2} \times (2)^2 = -0.18 \times 2 = -0.36$ m/s

$v_y = -0.4 \cdot \sin(0.2 \times 2) = -0.156$ m/s if rad yes

-0.003 m/s if degrees (-1)

don't subtract twice

12/12 5.



f = force of friction = $\mu \cdot mg \cdot \cos\theta$

F = 150 N

weight in downhill direction = $mg \sin\theta$

accel = 3.36 m/s² m = 20 kg

a) Net force in down hill direction

$F_{NET} = F - f + mg\sin\theta$ ②

① ①

9/9 $F = ma$ Net ②

$\therefore F - f + mg\sin\theta = m \cdot 3.36\ m/s^2$

③ $f = F + mg\sin\theta - m \cdot 3.36$

$= 150 + (20 \times 9.8 \times \sin(25)) - 20 \times 3.36$

176 → 82.8 − 67.2

15.633

$f = 165.6\ N$

-2 : Forget the downhill weight

-1 Confuses sin with cos

② $f = \mu mg\cos\theta \quad \therefore \mu = \frac{f}{mg\cos\theta} = \frac{165}{20 \times 9.8 \times \cos(25)}$

177.64

$\mu = 0.932$

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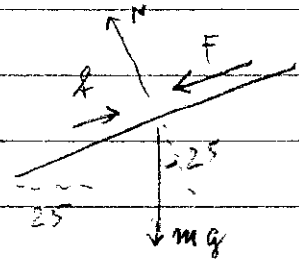
b) will it slide? F=0 $F_{NET} = -f + mg\sin\theta = ma = 0$ ②

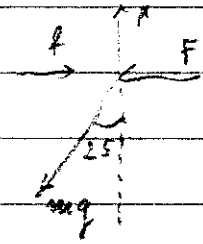
3/3 if for not sliding ① $f > mg\sin\theta \quad f > 82.8$

$\mu \cdot mg\cos\theta > 82.8 \quad \mu > \frac{82.8}{177.64} = 0.466$

177.64

yes, not slide


N
F
a
25
25
mg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