

Physics lab 111

Mid Exam

Student Name :

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Mark: // /20

Q1)

A) State the number of the significant figures in the following number: (1 points)

0.00053

B) Find out the sum of the numbers 39.34, 40.1, and 0.82

(1 points)

Q2) Determine the relative error in cylinder volume ( $V$ ) where ,  $D = (1.503 \pm 0.001 \text{ cm})$  and

$h = (4.553 \pm 0.002 \text{ cm})$  (4 points)

$$\bar{V} = \pi \left(\frac{d}{2}\right)^2 h$$

$$\bar{V} = \pi \left(\frac{1.503 \pm 0.001}{2}\right)^2 (4.553 \pm 0.002)$$

$$\bar{V} = 16.18 \text{ cm}^3$$

$$\begin{aligned} \Delta \bar{d} &= 0.001 \\ \Delta \bar{h} &= 0.002 \end{aligned}$$

$$\Delta \bar{V} = \bar{V} \left[ \left(\frac{2\Delta d}{d}\right)^2 + \left(\frac{\Delta h}{h}\right)^2 \right]^{\frac{1}{2}} \quad (-2)$$

$$\Delta \bar{V} = 16.18 \left[ \left(\frac{0.001 \times 2}{1.503 \pm 0.001}\right)^2 + \left(\frac{0.002}{4.553 \pm 0.002}\right)^2 \right]^{\frac{1}{2}}$$

$$\Delta \bar{V} = 0.012 \text{ cm}^3$$

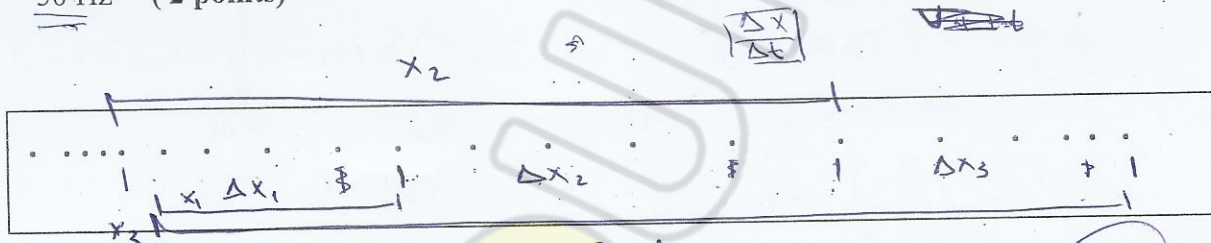
$$\frac{\Delta \bar{V}}{\bar{V}} = \frac{0.012}{16.18} \approx 0.00074$$

Q3) in Kinematics experiment

A) Which of the following statements is correct: (2 points)

- a- The dots on the tape represent position and time.
- b- The instantaneous velocity can be found directly from the tap.
- c- The maximum and minimum average velocity can be found directly from the tap.
- d- Both (a) and (c) are correct.

B) Find the instantaneous velocity at  $t = 0.15(s)$  where the frequency of the ticker timer is 50 Hz (2 points)



50 Hz  $\Rightarrow$  we take  $\Delta x$  every 5 points

$f = \frac{1}{T}$

$v = \frac{\Delta x}{\Delta t} = \frac{5.8}{0.15} = 38.66$  ~~cm/s~~  $\frac{2}{0.15} = 13.3$  cm/s

C) Describe the motion in the time period (0.10-0.30 s) whether increasing, decreasing, or constant velocity and state the reasons: (2 points)

The velocity of motion is increasing in  $\Delta x_2$  Period

& decreasing in  $\Delta x_3$  Period

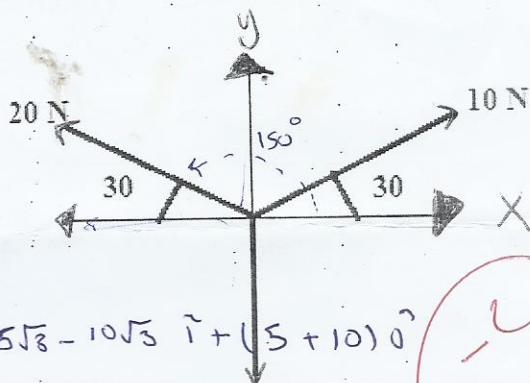
$\Delta x_2$  Period  $\Rightarrow$  From (0.1  $\rightarrow$  0.2) Sec

&  $\Delta x_3$  Period  $\Rightarrow$  From (0.2  $\rightarrow$  0.3) Sec

$T = \frac{1}{50}$   
 $T = 0.02$  Sec



Q4) Find the equilibrium force in (N) both magnitude and direction for the forces shown in the figure (4 points)



$$R_1 = 10 \cos(30) \hat{i} + 10 \sin(30) \hat{j}$$

$$R_1 = 5\sqrt{3} \hat{i} + 5 \hat{j}$$

$$|R_1| = \sqrt{(5\sqrt{3})^2 + 5^2} = \sqrt{100} = 10 \text{ N}$$

$$\theta_1 = \tan^{-1}\left(\frac{5}{5\sqrt{3}}\right) = 30^\circ$$

$$R_2 = 20 \cos(150) \hat{i} + 20 \sin(150) \hat{j}$$

$$= -10\sqrt{3} \hat{i} + 10 \hat{j}$$

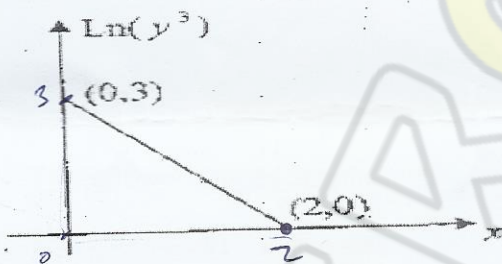
$$|R_2| = \sqrt{(-10\sqrt{3})^2 + 10^2} = \sqrt{400} = 20 \text{ N}$$

$$\theta_2 = \tan^{-1}\left(\frac{10}{-10\sqrt{3}}\right) = 150^\circ$$

$$\vec{R} = 5\sqrt{3} - 10\sqrt{3} \hat{i} + (5 + 10) \hat{j}$$

$$|\vec{R}| = \sqrt{30^2}$$

Q5) Deduce the empirical relationship that describes the curve in the graph. (4 points)



$$\ln(y^3) = 0 \Rightarrow x = 2$$

$$\ln(y^3) = 3 \Rightarrow x = 0$$

$$y = mx + b \quad \text{.. Linear equation Form}$$

$$m = \frac{3-0}{0-2} = -\frac{3}{2}$$

$$b = -2$$

$$\therefore \ln(y^3) = -\frac{3}{2}x - 2$$

$$\frac{\ln(y^3)}{3} = \frac{-\frac{3}{2}x - 2}{3}$$

$$\ln(y) = -\frac{1}{2}x - \frac{2}{3}$$

$$y = e^{-(\frac{1}{2}x + \frac{2}{3})}$$