

# Gestione della privacy (GDPR)

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Si consiglia in via generale di:

- silenziare il microfono e disattivare la videocamera se non necessari;
- prestare attenzione nell'utilizzo della funzione di condivisione dello schermo, onde evitare la visualizzazione di contenuti personali;
- non registrare le lezioni con dispositivi esterni alla piattaforma (es. il cellulare); si ricorda che è vietato registrare esami o sessioni di laurea.
- non utilizzare la piattaforma o la chat per comunicazioni non pertinenti al contenuto delle lezioni, per finalità estranee o per domande relative a carriera universitaria o altre situazioni personali;
- prestare attenzione all'inserimento di documenti, onde evitare di condividere contenuti protetti da copyright, non pertinenti alle lezioni o comunque personali;
- utilizzare la funzione di sfocatura dello sfondo se la videocamera è attivata e la partecipazione avviene da ambiente domestico.

Si raccomanda di visualizzare all'inizio della registrazione delle lezioni le indicazioni sopra riportate o comunque richiamarle.

# Link 31/03/2020

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## ➤ Link alle due lezioni registrate:

- <https://drive.google.com/open?id=1AqCayGonzXsH5MtUzKFIUhIpacWcmYBN>
- <https://drive.google.com/open?id=10T7FptU-DWUpuY5FUqYa6sOQRDsaKgwG>

# Lavagna 1 31/3

29 Mar 21 mar

$2.4\text{ s}, 2.3, 2.5, 2.4\text{ s}$  31/03/2020

$t = 2.4\text{ s}$   
 $2.3\text{ e } 2.5\text{ s}$

TEMPO MISURATO

$x_{\text{best}} - \delta x$

$x_{\text{best}} + \delta x$

$(2.4 \pm 0.1)\text{ s}$

$x_{\text{best}}$   $\delta x$

# Lavagna 2 31/3

Handwritten notes on a green chalkboard showing the calculation of relative error for acceleration  $g$ .

At the top, the acceleration is given as  $g = (9,82 \pm 0,02) \text{ m s}^{-2}$ . A circled '1' is written to the left. An arrow points from the error term  $0,02$  to a calculation:  $\frac{0,01885}{0,02}$ , where  $0,01885$  is circled.

Below this, the relative error is defined as  $\nu = \frac{\Delta}{t}$ , with arrows pointing from  $\Delta$  to  $d_b$  and from  $t$  to  $t_b$ . The corresponding absolute error is given as  $d_b \pm \Delta d$  and  $t_b \pm \Delta t$ .

The relative error for the base quantity is  $\nu_b = \frac{d_b}{t_b}$ . The error propagation formula is written as  $\Delta \nu = f\left(\frac{\Delta d}{d}, \frac{\Delta t}{t}\right)$ .

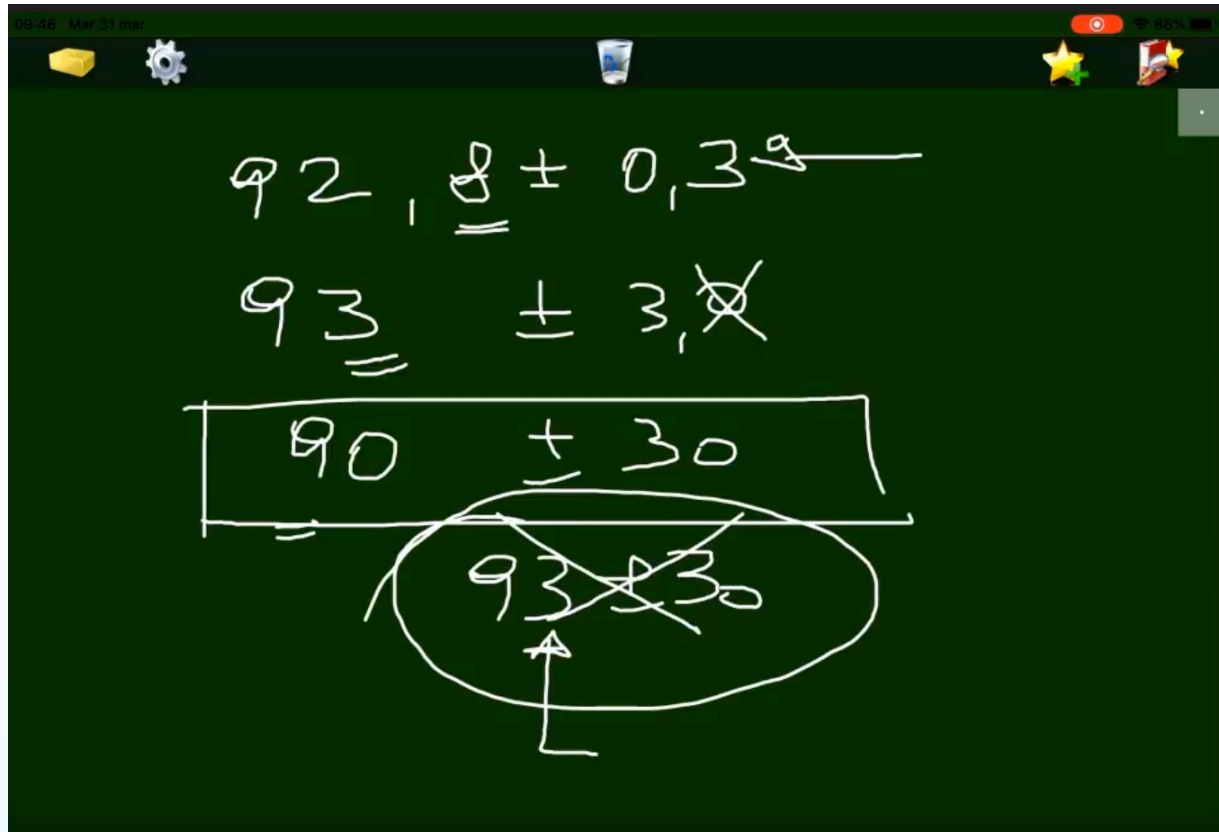
At the bottom, a calculation shows  $0,01$  followed by a bracketed expression  $0,010 \pm 0,015$  and  $0,06 \rightarrow 0,2$ .

# Lavagna 3 31/3

The image shows a green chalkboard with handwritten mathematical work. At the top, there is a header "Lavagna 3 31/3". The main content consists of several lines of text and equations:

- The first line is  $N_{mis} = 6051,78 \pm 30 \text{ m s}^{-1}$ . The number 6051,78 has a bracket underneath it, and the 30 has a double underline underneath it.
- The second line is  $6051,78 \div 6051,78$ . The 6051,78 on the left has a double underline underneath it, and the 6051,78 on the right has a double underline underneath it.
- The third line is  $605X, \cancel{78}$ . An arrow points from the 'X' down to the next line.
- The fourth line is  $6050 \pm 30$ .
- The fifth line is  $6056 \pm 30 \rightarrow 6060 \pm 30$ .

# Lavagna 4 31/3



# Lavagna 5 31/3

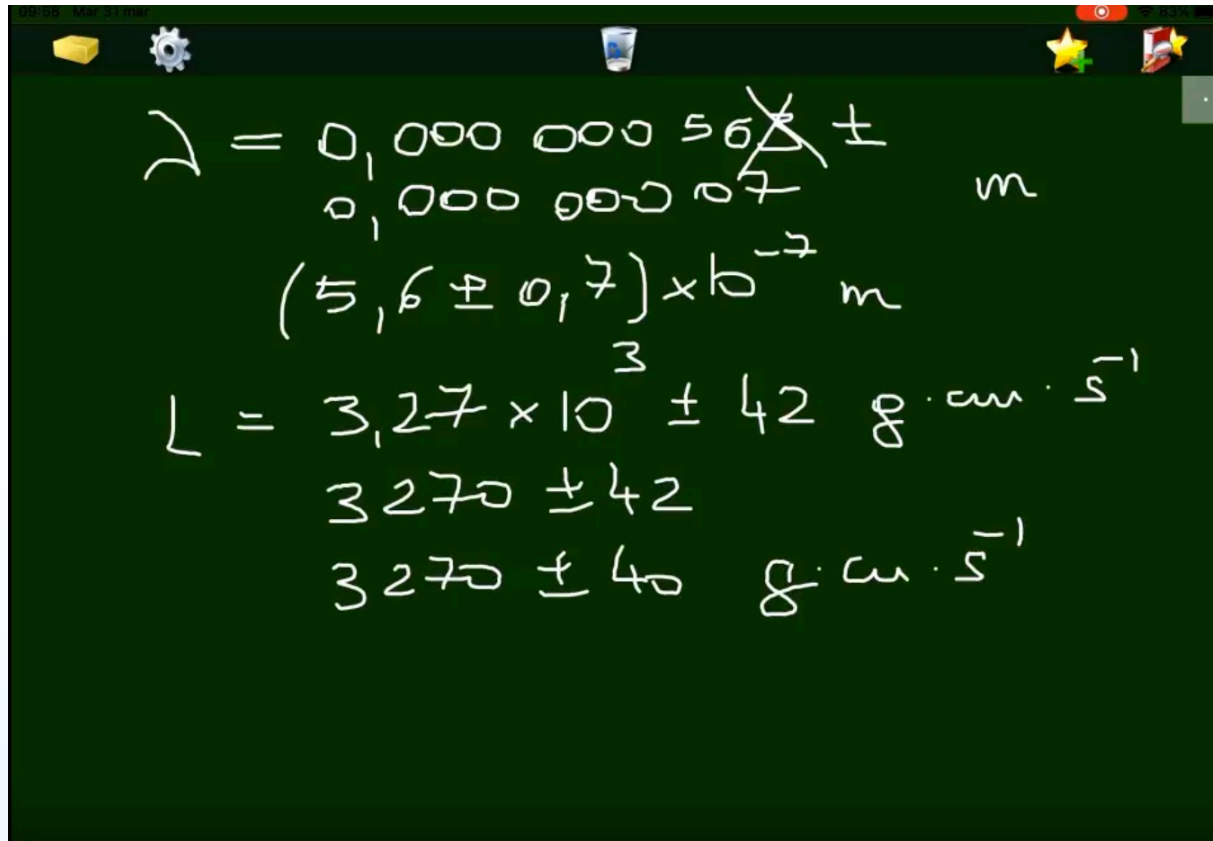
2.2  $5,03 \pm 0,04329 \text{ m}$   
 $(5,03 \pm 0,04) \text{ m}$

$19,5432 \pm 1 \text{ s}$        $20 \pm 1 \text{ s}$   
 $19 \pm 1 \text{ s}$

$19,5 \pm 1,0 \text{ s}$

$-3,21 \times 10^{-19} \pm 2,67 \times 10^{-20} \text{ C}$   
 $-32 \times 10^{-20} \pm 2,7 \times 10^{-20} \text{ C}$   
 $(-32 \pm 3) \times 10^{-20} \text{ C}$

# Lavagna 6 31/3



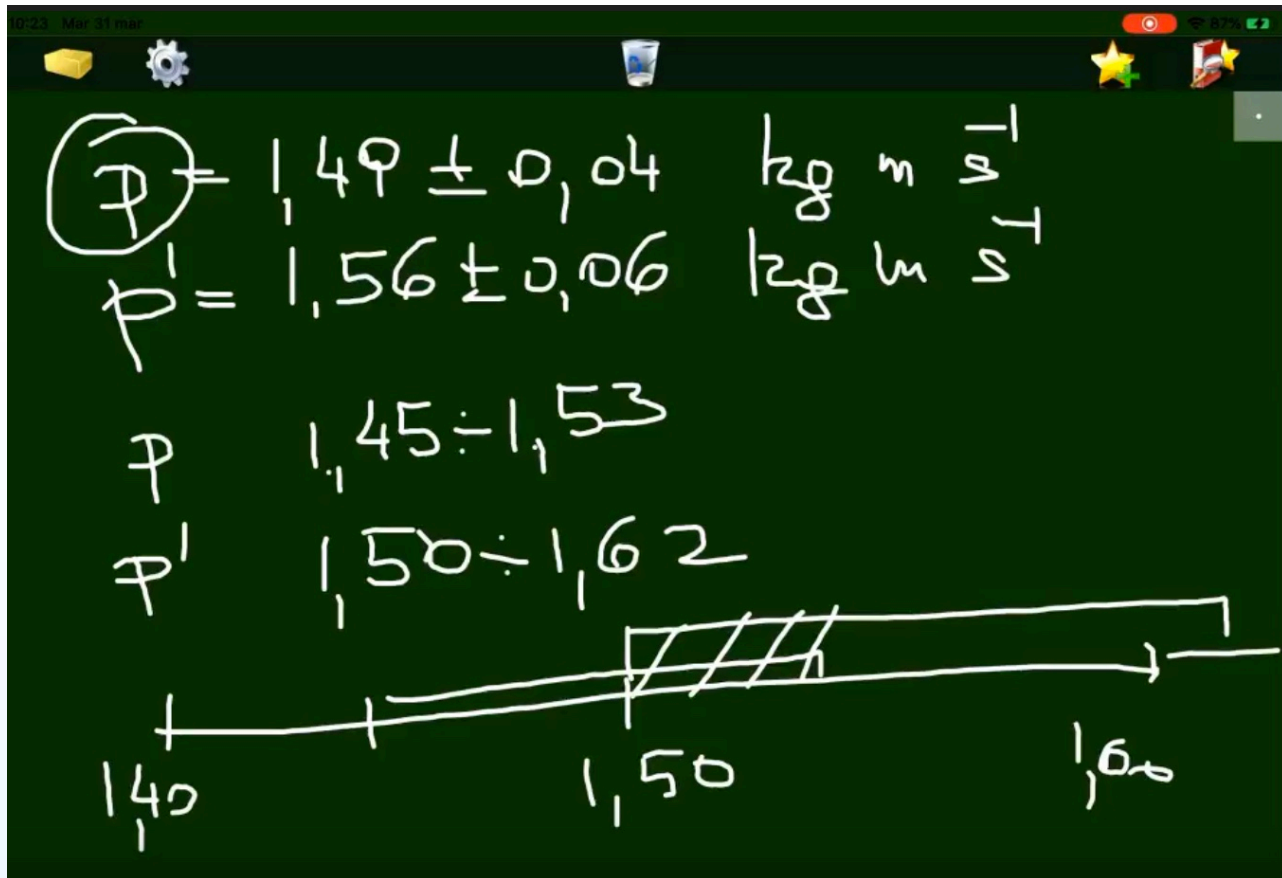
The image shows a green chalkboard with handwritten mathematical expressions. At the top, there are several small icons: a yellow cube, a gear, a glass of water, a yellow star, and a red star. The main content consists of three lines of text:

$$\lambda = \frac{0,000\ 000\ 56 \pm 0,000\ 000\ 07}{(5,6 \pm 0,7) \times 10^{-7}} \text{ m}$$
$$L = 3,27 \times 10^3 \pm 42 \text{ g} \cdot \text{cm} \cdot \text{s}^{-1}$$
$$3270 \pm 42$$
$$3270 \pm 40 \text{ g} \cdot \text{cm} \cdot \text{s}^{-1}$$





# Lavagna 8 31/3 - 2<sup>a</sup> ora



# Lavagna 9 31/3 – 2<sup>a</sup> ora

The image shows a chalkboard with handwritten data for two groups, P and P'. The data is organized into three rows. Below the data, there are error bars for each group and a calculation for the difference between the groups.

|   | P            | P'           |    |
|---|--------------|--------------|----|
| 1 | 1,49         | 1,56         | ✓  |
| 2 | 2,10         | 2,12         | ✓  |
| 3 | 1,16         | 1,05         | ~✓ |
|   | $\pm 0,04$   | $\pm 0,06$   |    |
|   | $1,12 = 1,2$ | $0,99 = 1,1$ |    |

# Lavagna 10 31/3 - 2<sup>a</sup> ora

$(\Delta p) = p - p'$

$p_b, p'_b$   
 $\delta p, \delta p'$

$\Delta \phi = p_b - p'_b$   
 $\delta_{\Delta \phi}$

$(p_b + \delta p) \rightarrow p_b - \delta p$   
 $(p'_b - \delta p') \rightarrow p'_b + \delta p'$

**MAX  $\Delta \phi$**   
 $\Delta \phi^{\text{MAX}} = p_b + \delta p - (p'_b - \delta p')$   
 $= p_b - p'_b + (\delta p + \delta p')$

**MIN  $\Delta \phi$**   
 $\Delta \phi^{\text{MIN}} = p_b - \delta p - (p'_b + \delta p') =$   
 $= p_b - p'_b - (\delta p + \delta p')$

20:26 / 46:59

# Lavagna 11 31/3 - 2<sup>a</sup> ora

(misura  $\Delta p$ ) =  $\Delta p_b \pm \delta(\Delta p)$

$$\Delta p_b = p_b \cdot p'_b$$
$$\delta(\Delta p) = \delta p + \delta p'$$

|      |      |                                      |
|------|------|--------------------------------------|
| 1,49 | 1,56 | $-0,02 \pm 0,10$                     |
| 2,10 | 2,12 | $-0,02 \pm 0,10$                     |
| 1,16 | 1,05 | $0,11 \pm 0,10$                      |
|      |      | <del><math>-0,1 \pm 0,1</math></del> |

▶ 🔊 24:06 / 46:59

# Lavagna 12 31/3 – 2<sup>a</sup> ora

$\Delta \phi = p - p' \rightarrow 0$

$R = \phi / \phi' \rightarrow 1$

$\Delta$  → in certezza

$\Delta$  → DIFF.

$\Delta t$        $\Delta x$

# Lavagna 13 31/3 - 2<sup>a</sup> ora

MISURA  $x \pm \delta x$

~~INCERTIZZA~~ ~~FRADIZIALE~~

ERRORE RELATIVO

$$\frac{\delta x}{x_b} \quad \ell = 50 \pm 1 \text{ cm}$$
$$x_b = 50 \text{ cm}$$
$$\frac{\delta x}{x_b} = \frac{1}{50} = 0,02$$
$$= 2\%$$

|       |      |
|-------|------|
| 0,002 | 0.2% |
|       | 2%   |

33:41 / 46:59

# Lavagna 14 31/3 - 2<sup>a</sup> ora

11:52 Mar 31 mar 99%

|             |         |  |   |
|-------------|---------|--|---|
| $\mu_i$     | $\mu_f$ | $\mu_i - \mu_f$                              | $\text{con } \bar{s}'$                              |
| 1) $(14.0)$ | 18.0    | $-4.0 \pm 0.3$                               | $\delta \bar{I}_0$                                  |
| 2) 19.0     | 19.6    | $-0.6 \pm 0.4$                               |   |
|             |         | <u><math>-4.0 \pm 0.3</math></u>             |   |
|             |         | $\frac{0.3}{ -4.0 } = \frac{0.3}{4} = 0.075$ | $\frac{0.15}{1/2} = 0.075$                          |
|             |         | $-4.0 \pm 0.3$                               | $= 0.075 = 0.08 = 8\%$                              |
|             |         | $-0.6 \pm 0.4$                               | $\frac{0.4}{0.6} = \frac{4}{6} = 0.67 = 0.7 = 70\%$ |