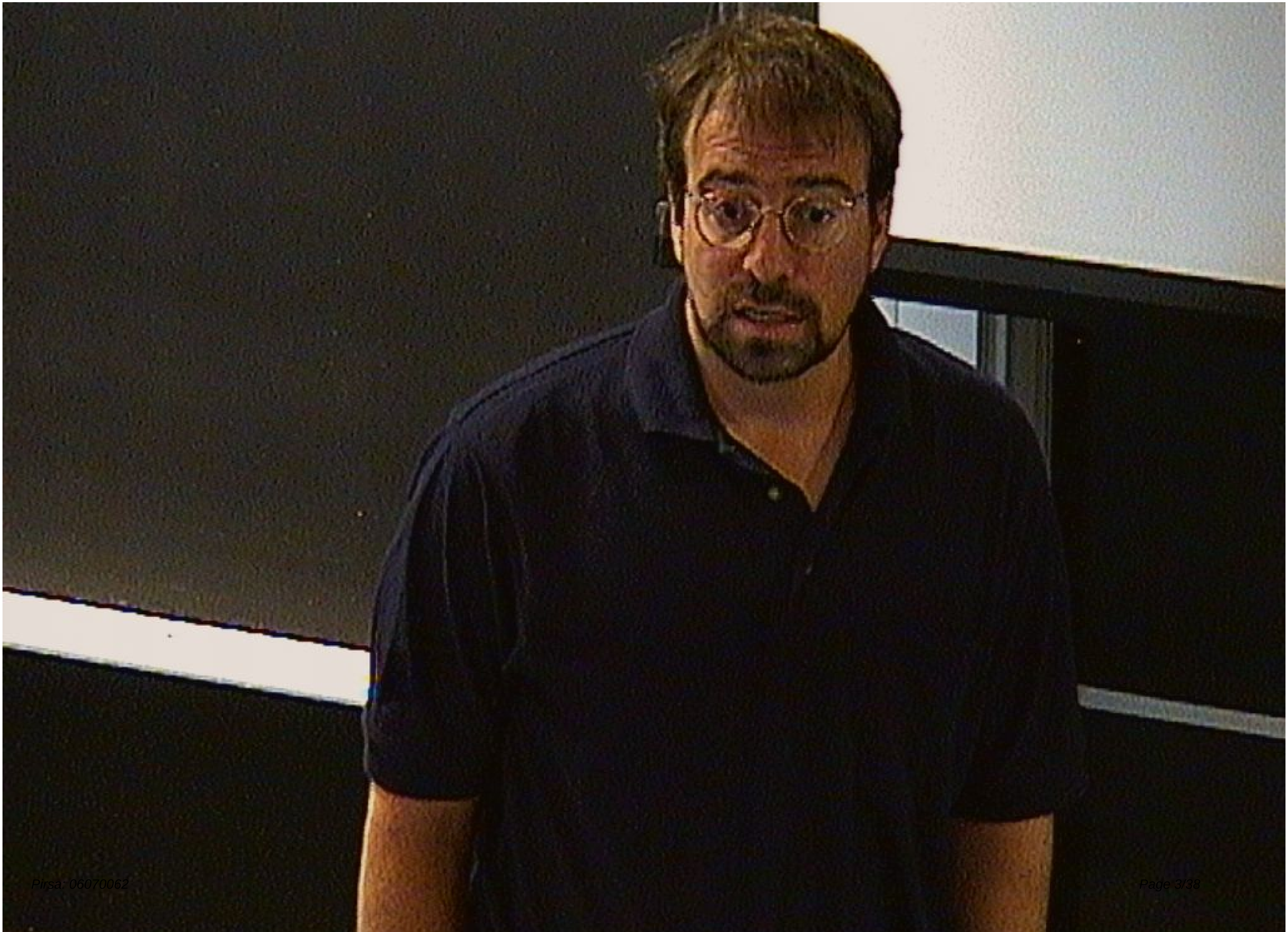
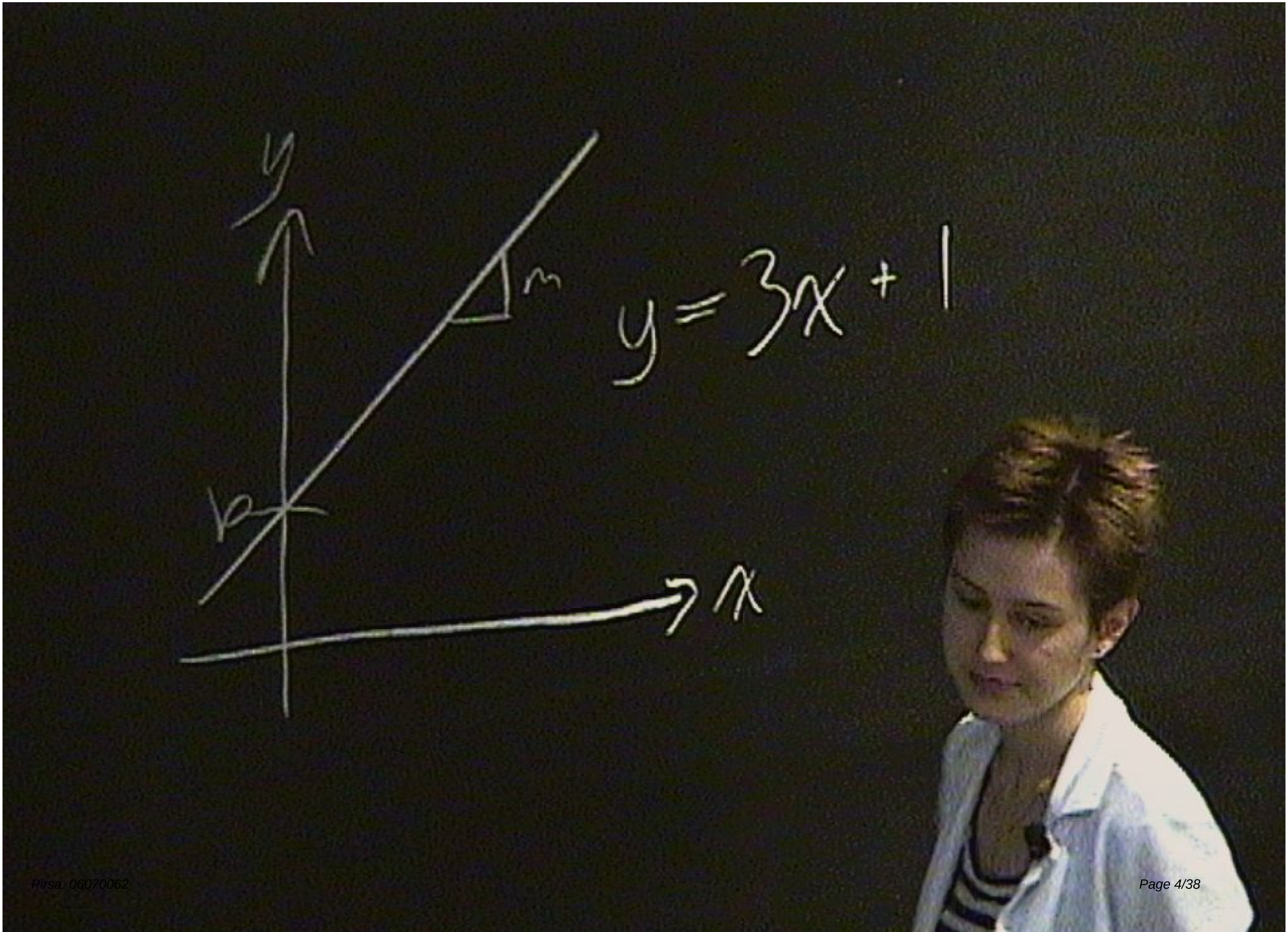
Title: Introduction and Math Primer: Differentiation

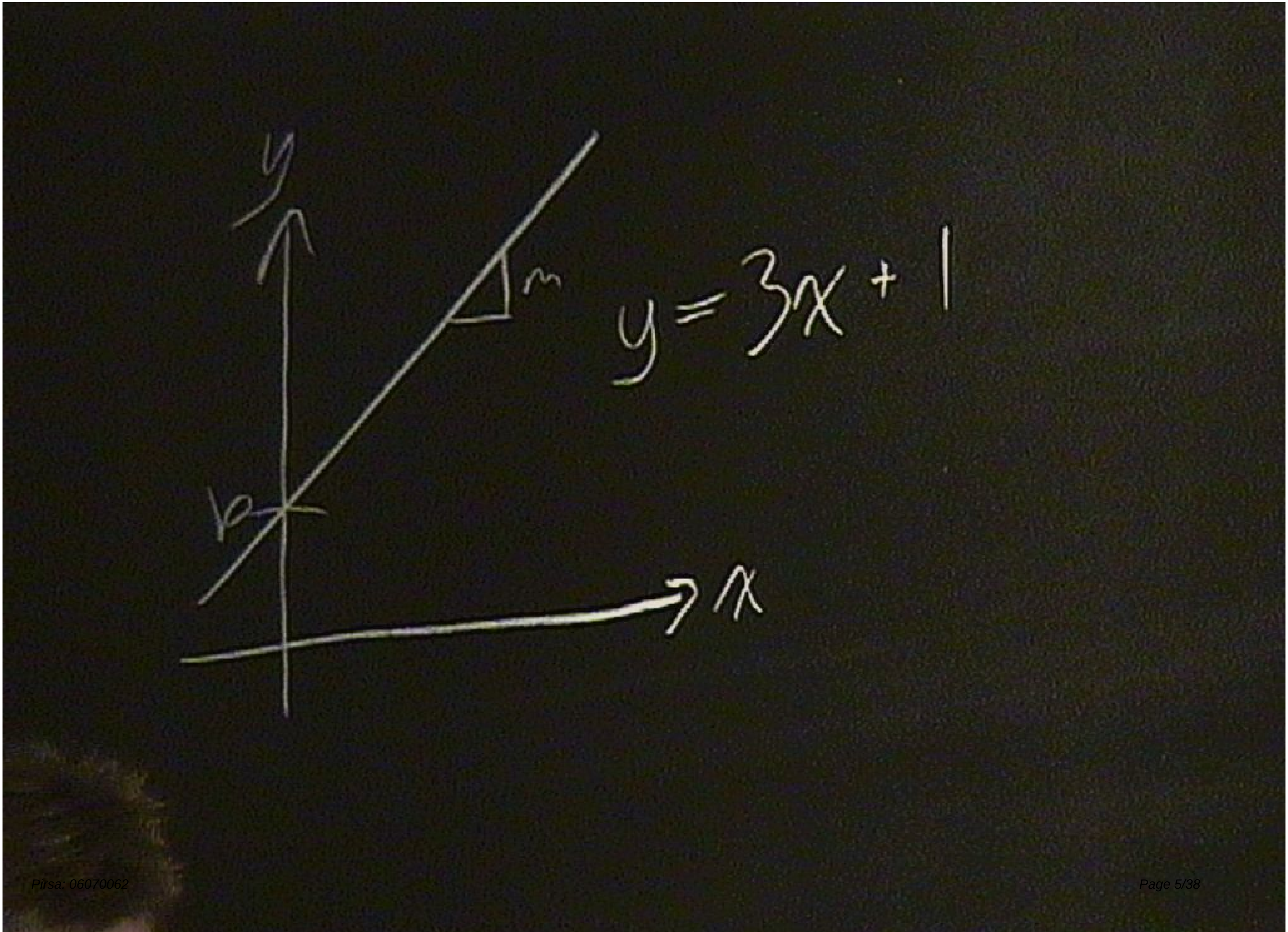
Date: Jul 24, 2006 09:00 AM

URL: http://pirsa.org/06070062

Abstract:




y
m
y = 3x + 1
b
x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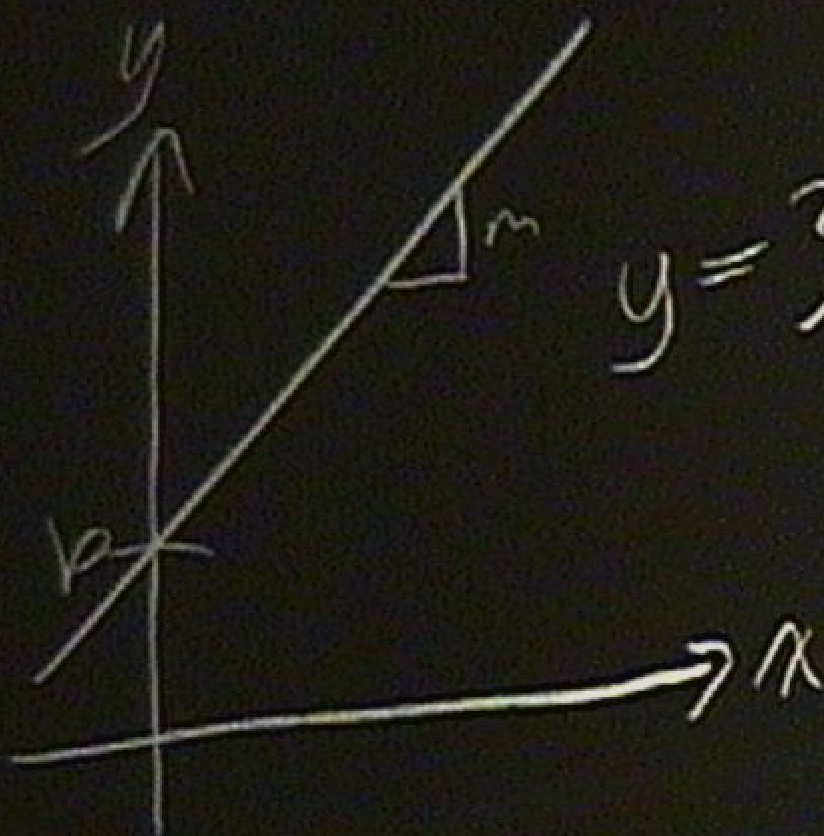
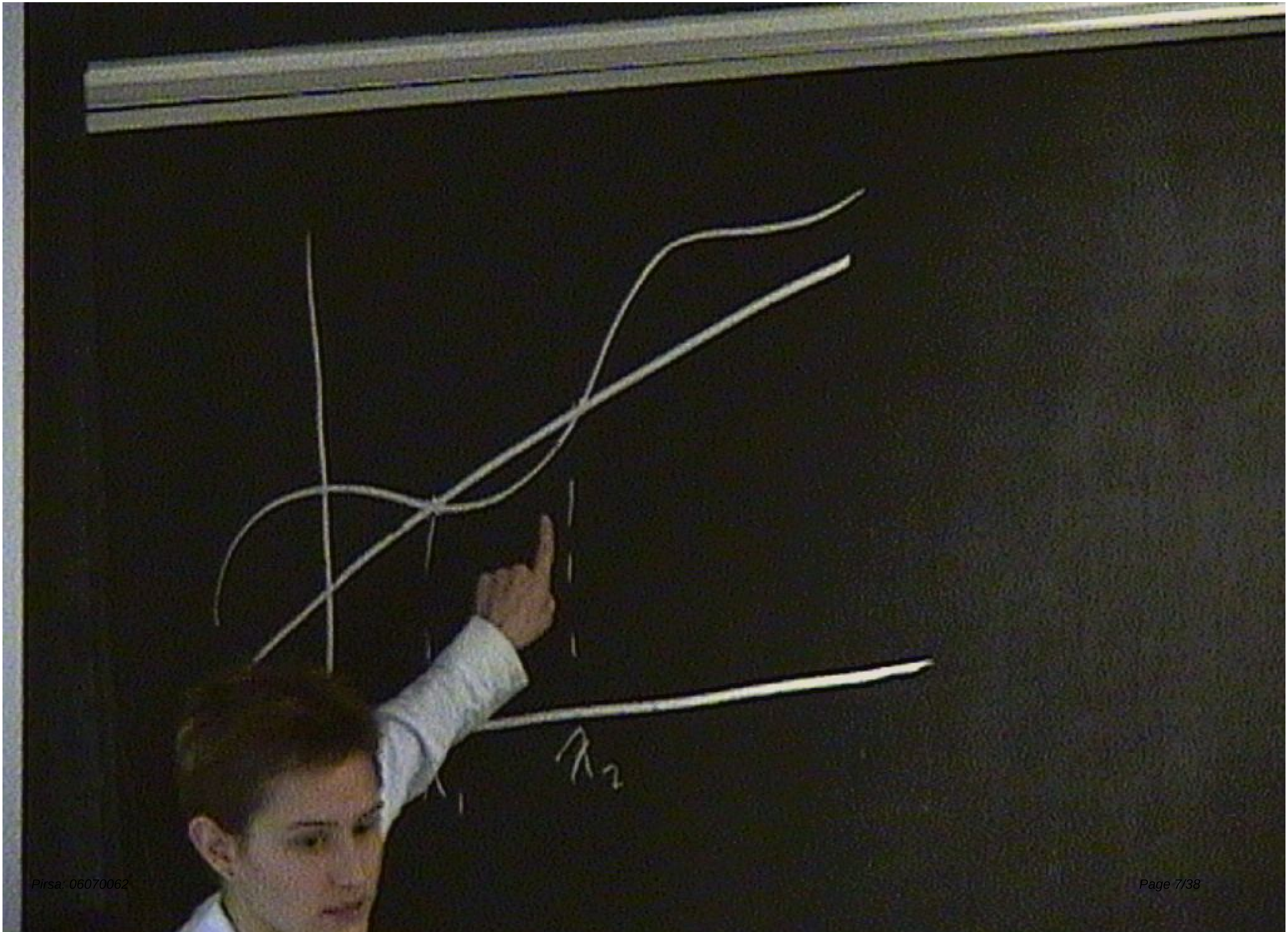
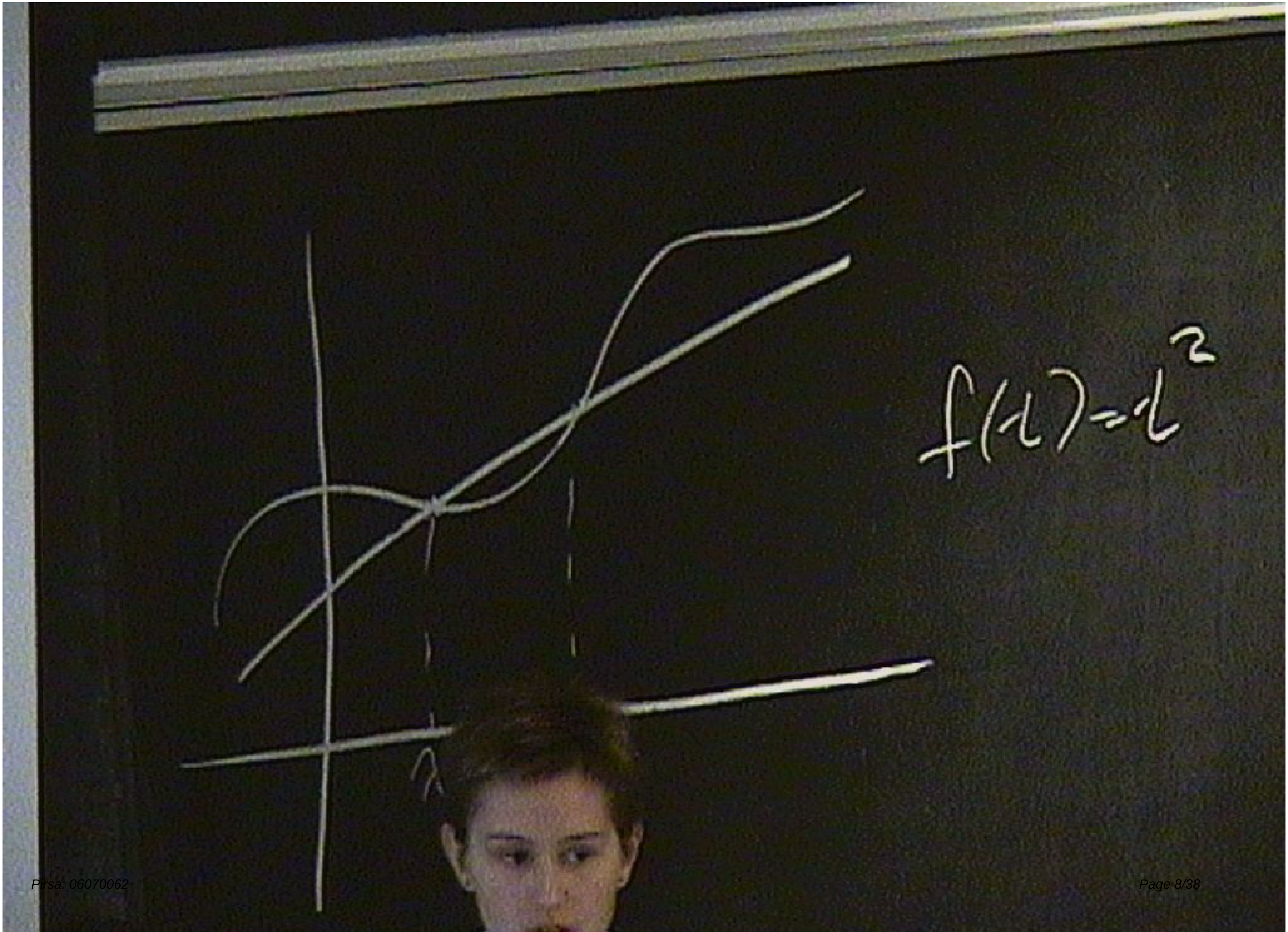
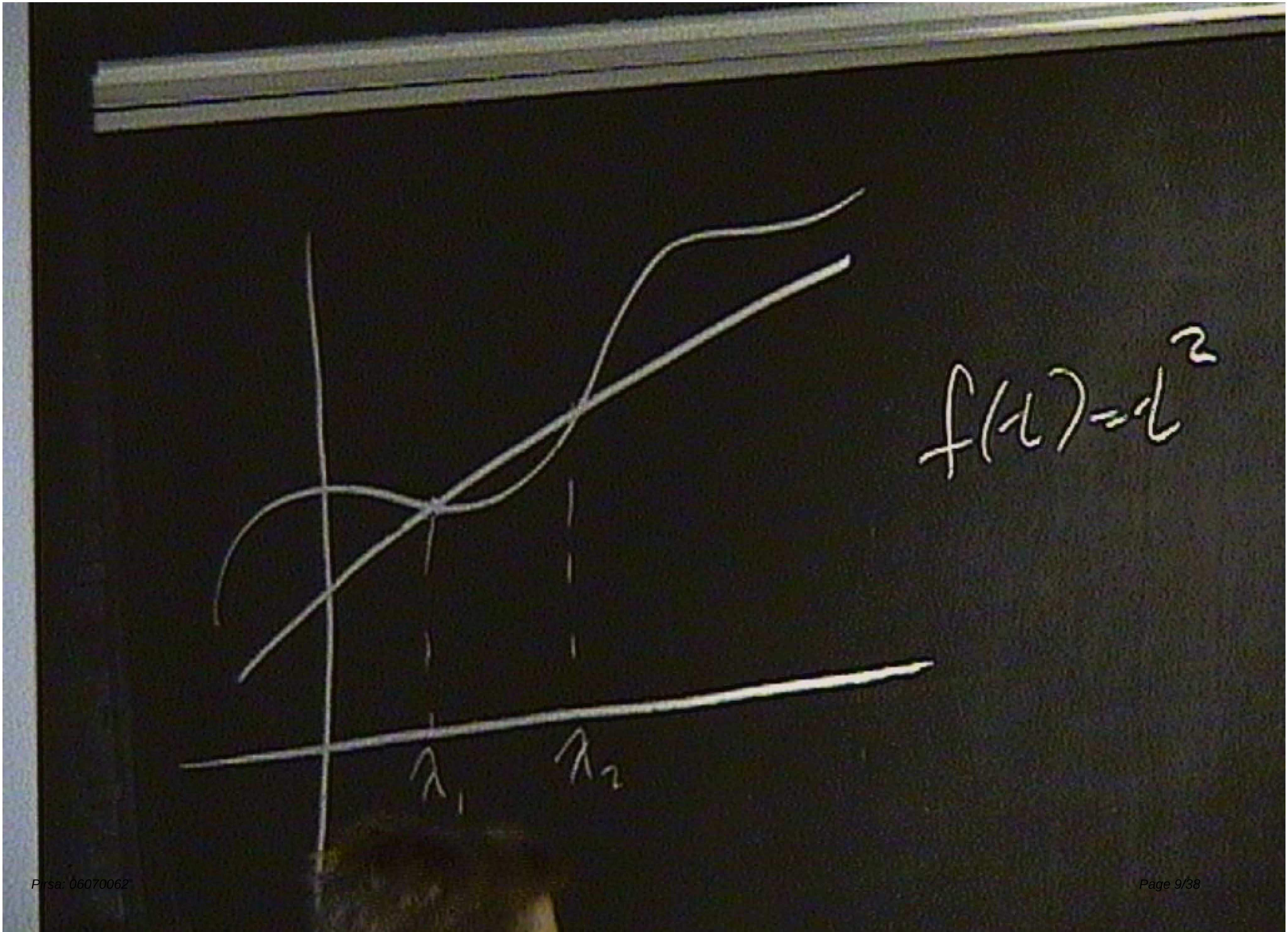


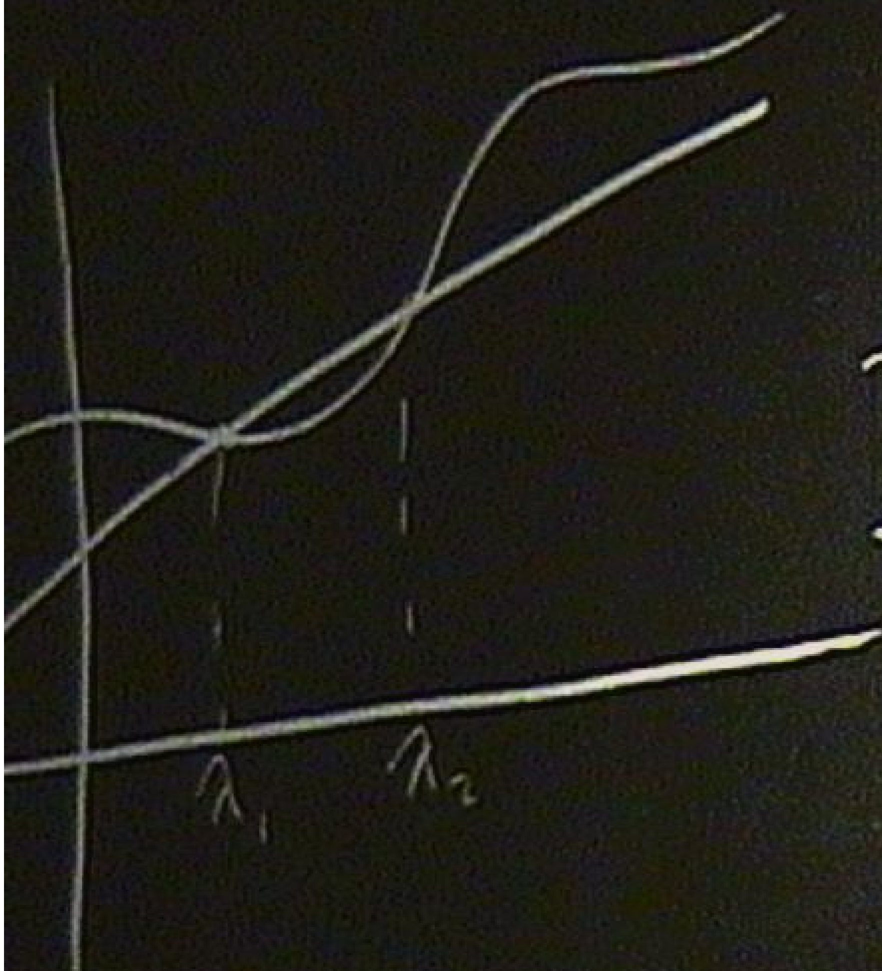
$$y = 3x + 1$$

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$


λ_1
λ_2


f(λ)=λ²
λ


$f(\lambda)=\lambda^2$
λ_1
λ_2



$$f(t)=t^2 \qquad m_s = \frac{f(5)-f(3)}{5-3}$$

$$t_1=3 \quad t_2=5 \qquad = \frac{25-9}{2}$$

$$= \frac{16}{2} = 8$$

Problem Set (1) – Slope

1) If $f(x)=2x^3+5$, what is the slope of the secant between $x_1=1$ and $x_2=4$?

2) If $g(\theta)=\theta^2-3\theta$, what is the average rate of change of θ between $\theta_1=2$ and $\theta_2=7$?

3) If $r(t)=8-2t^2$, what is the average speed between $t_1=0$ and $t_2=2$?

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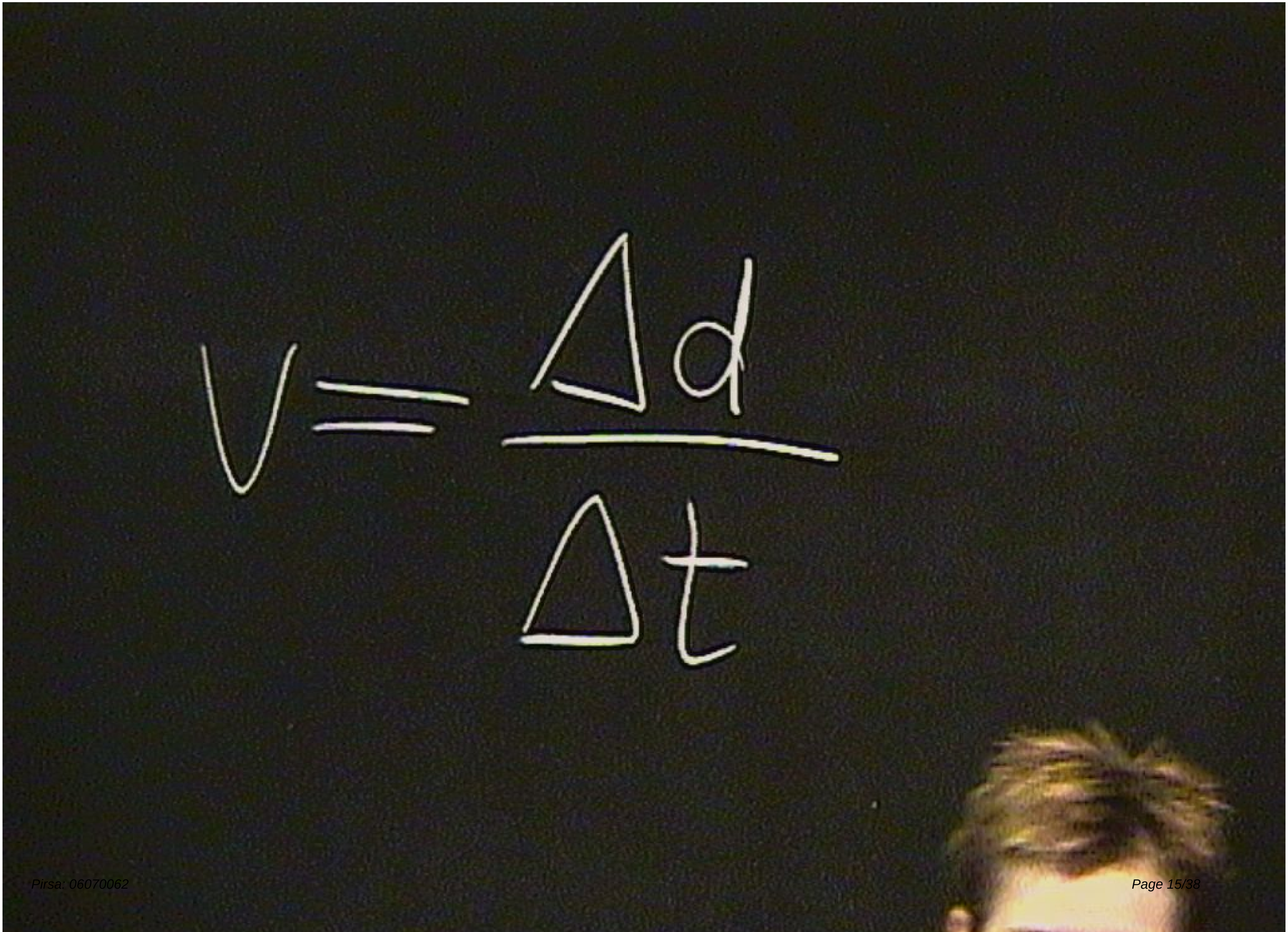
3) If $r(t)=8-2t^2$, what is the average speed between $t_1=0$ and $t_2=2$?

$$f(x) = 2x^2 + 4$$

$$f(2)$$

$$m_s = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$


$v = \frac{\Delta d}{\Delta t}$

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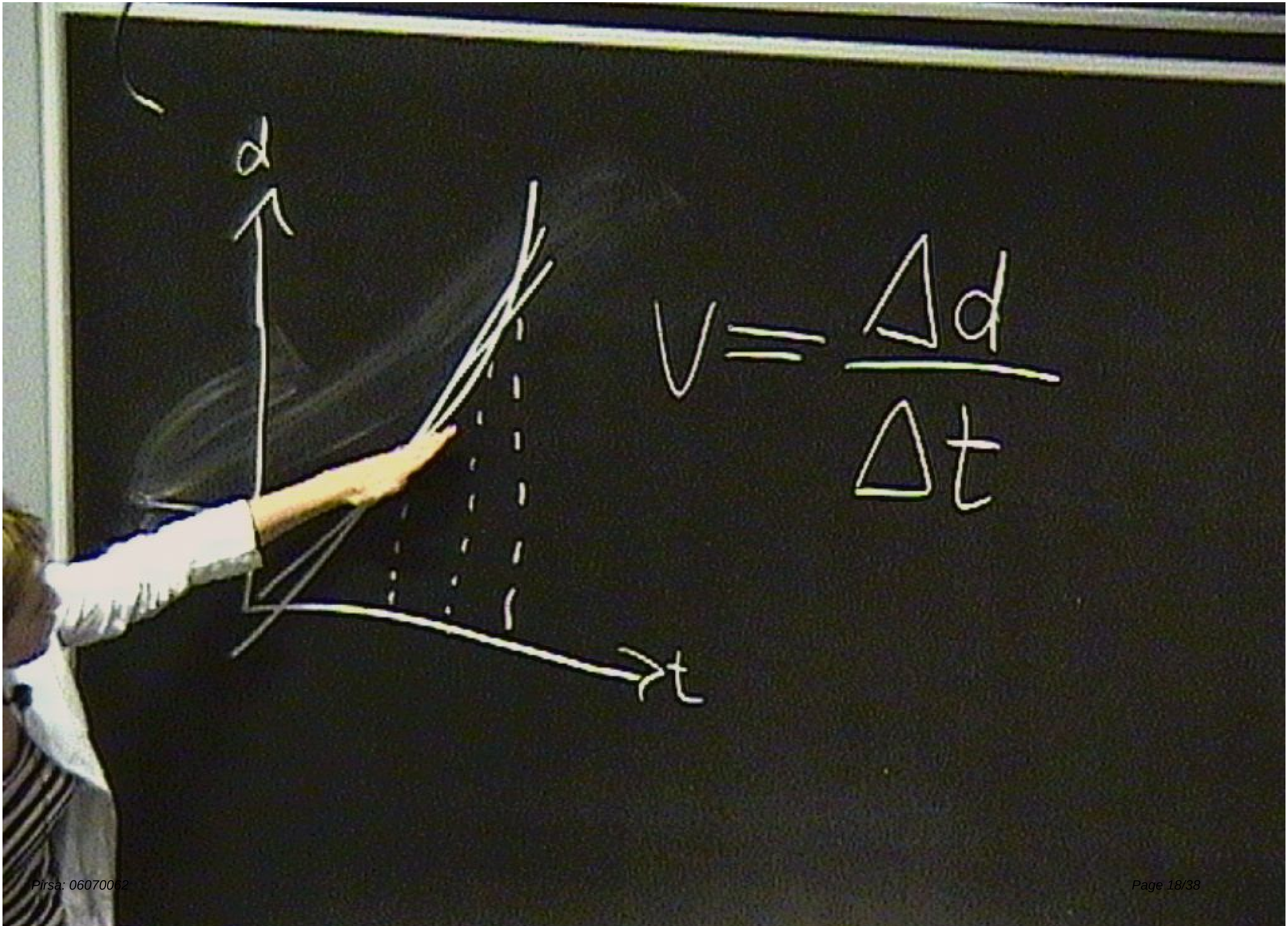
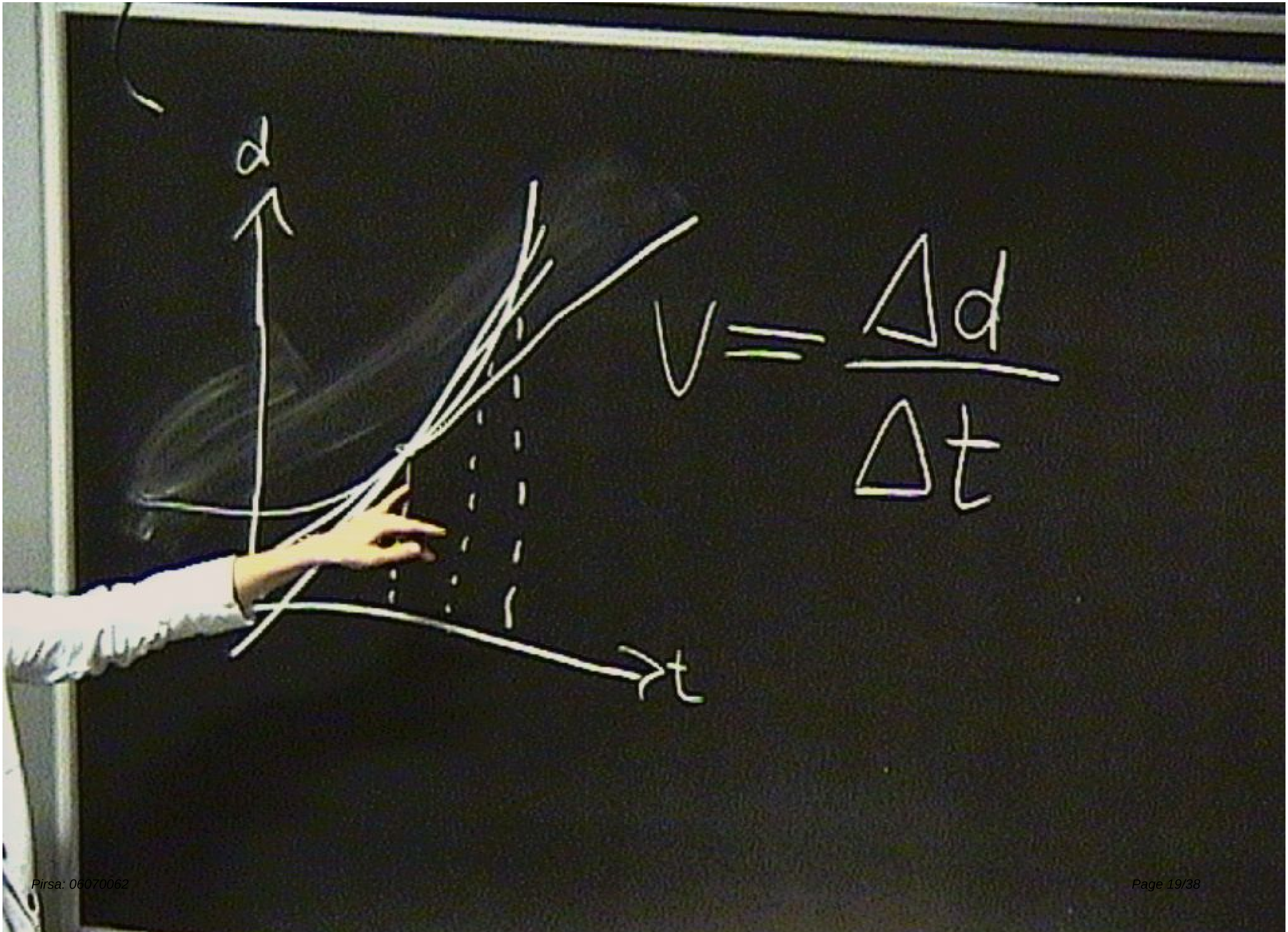

d
t
V = Δd / Δt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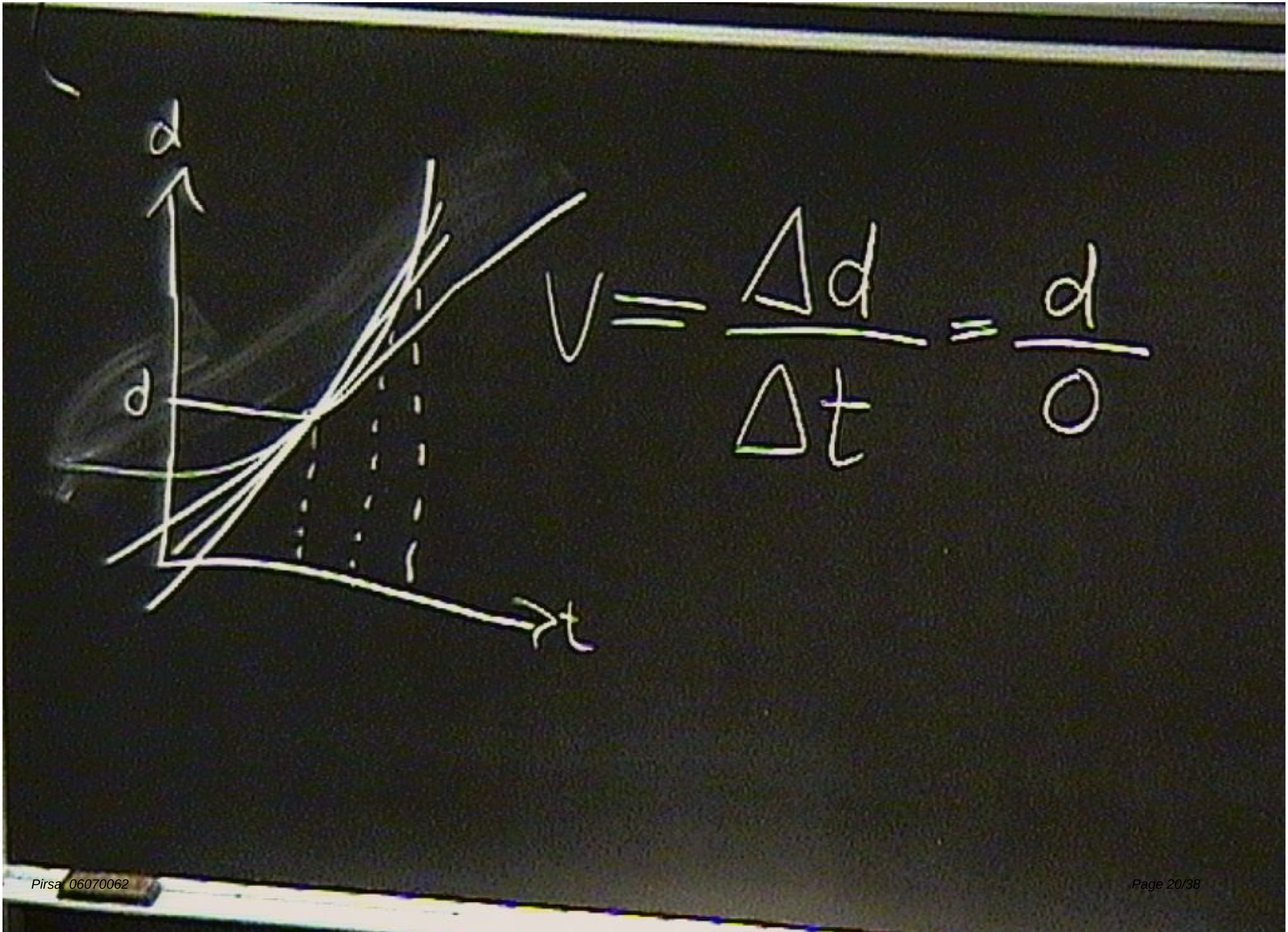
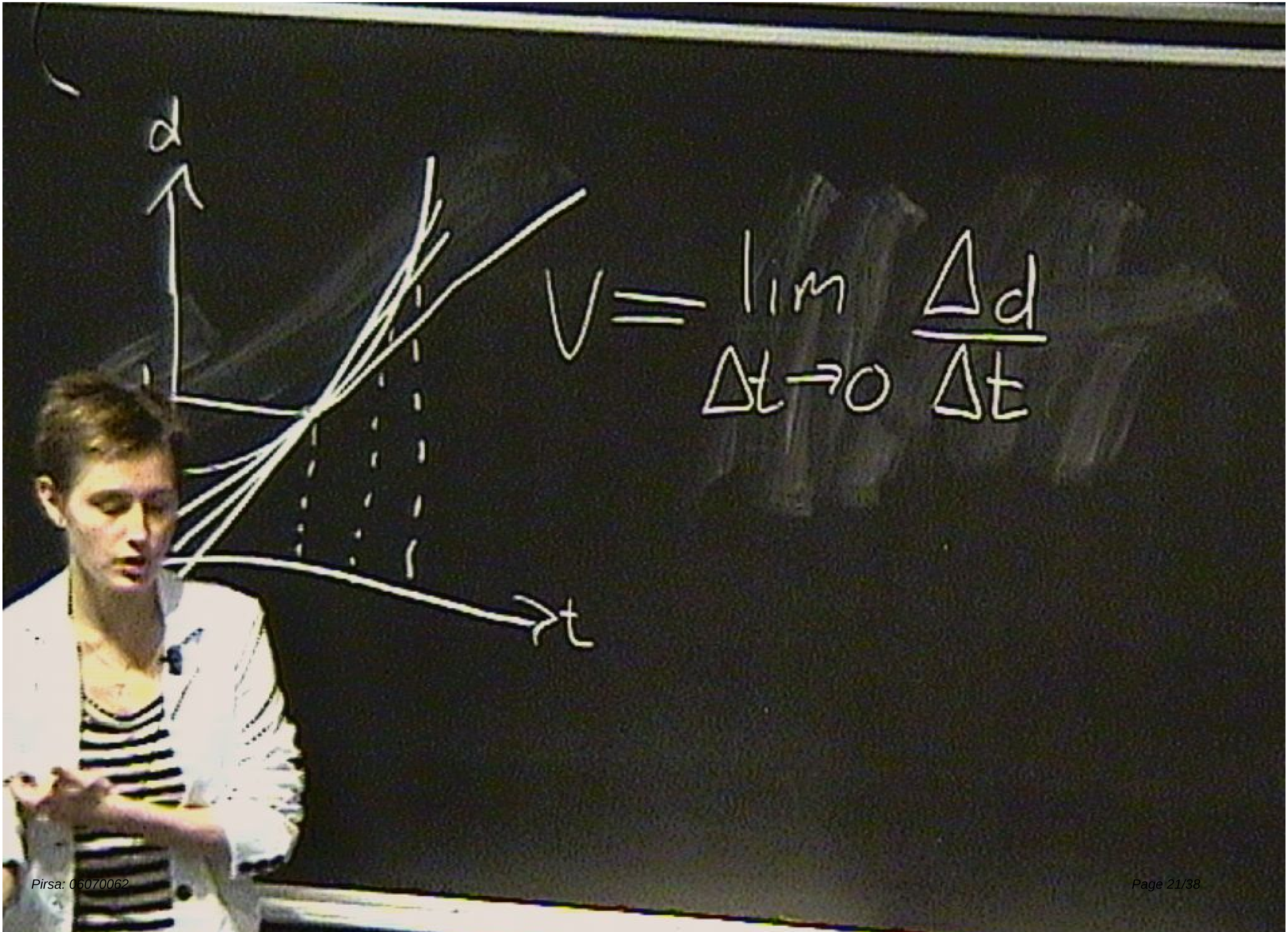
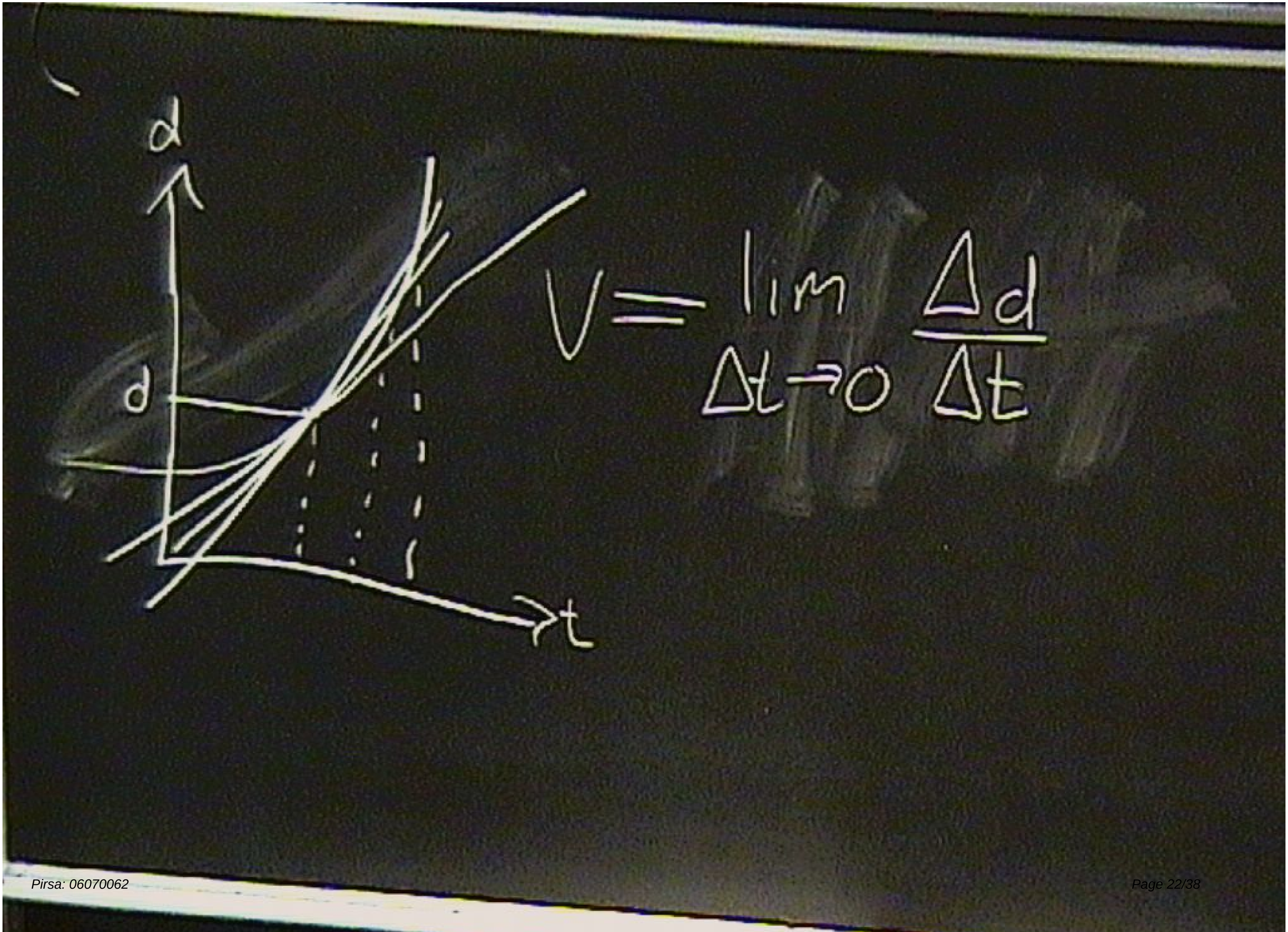

d
d
t
$V = \frac{\Delta d}{\Delta t} = \frac{d}{0}$


d
t
$V = \lim_{\Delta t \to 0} \frac{\Delta d}{\Delta t}$


d
d
t
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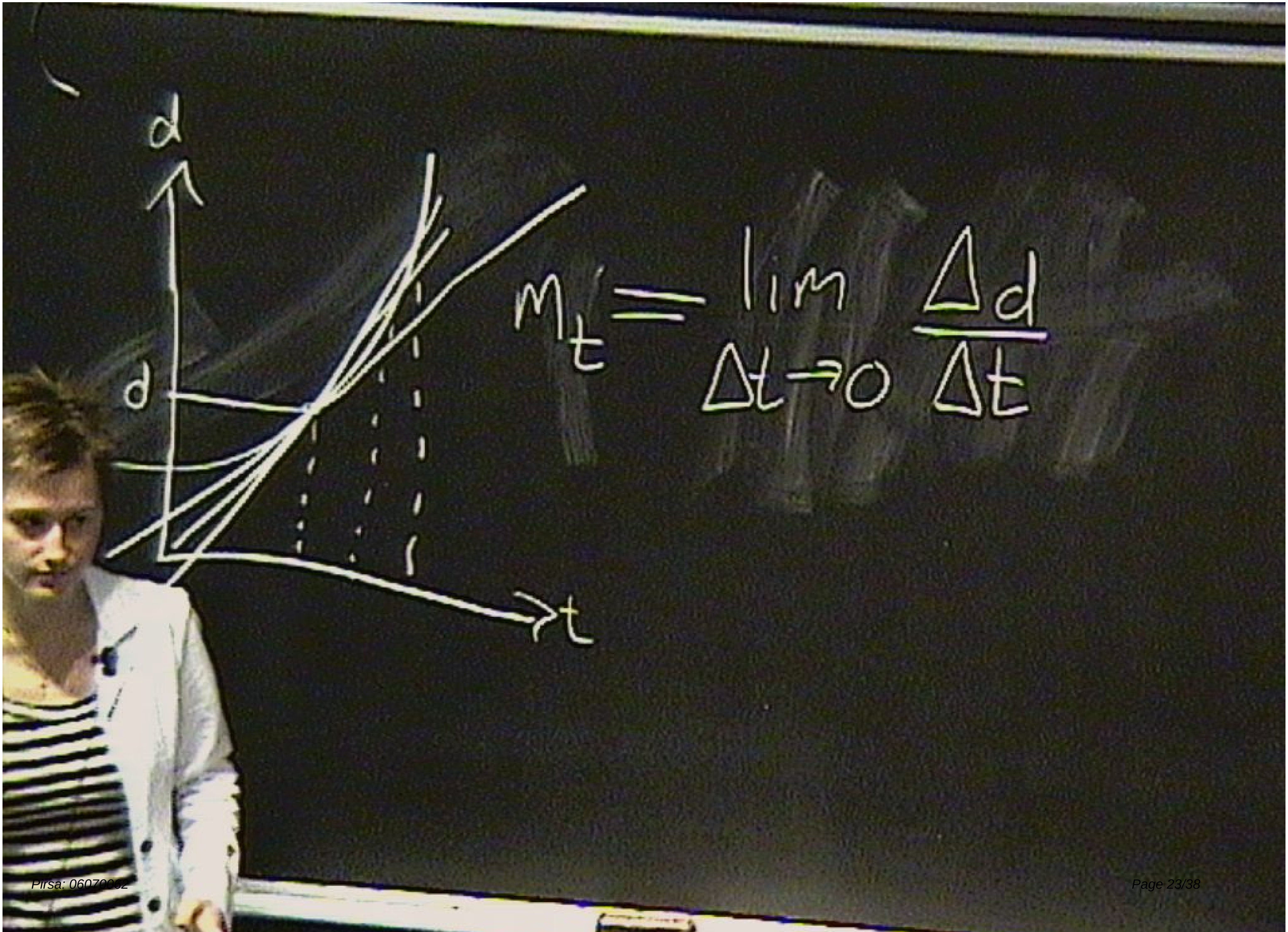
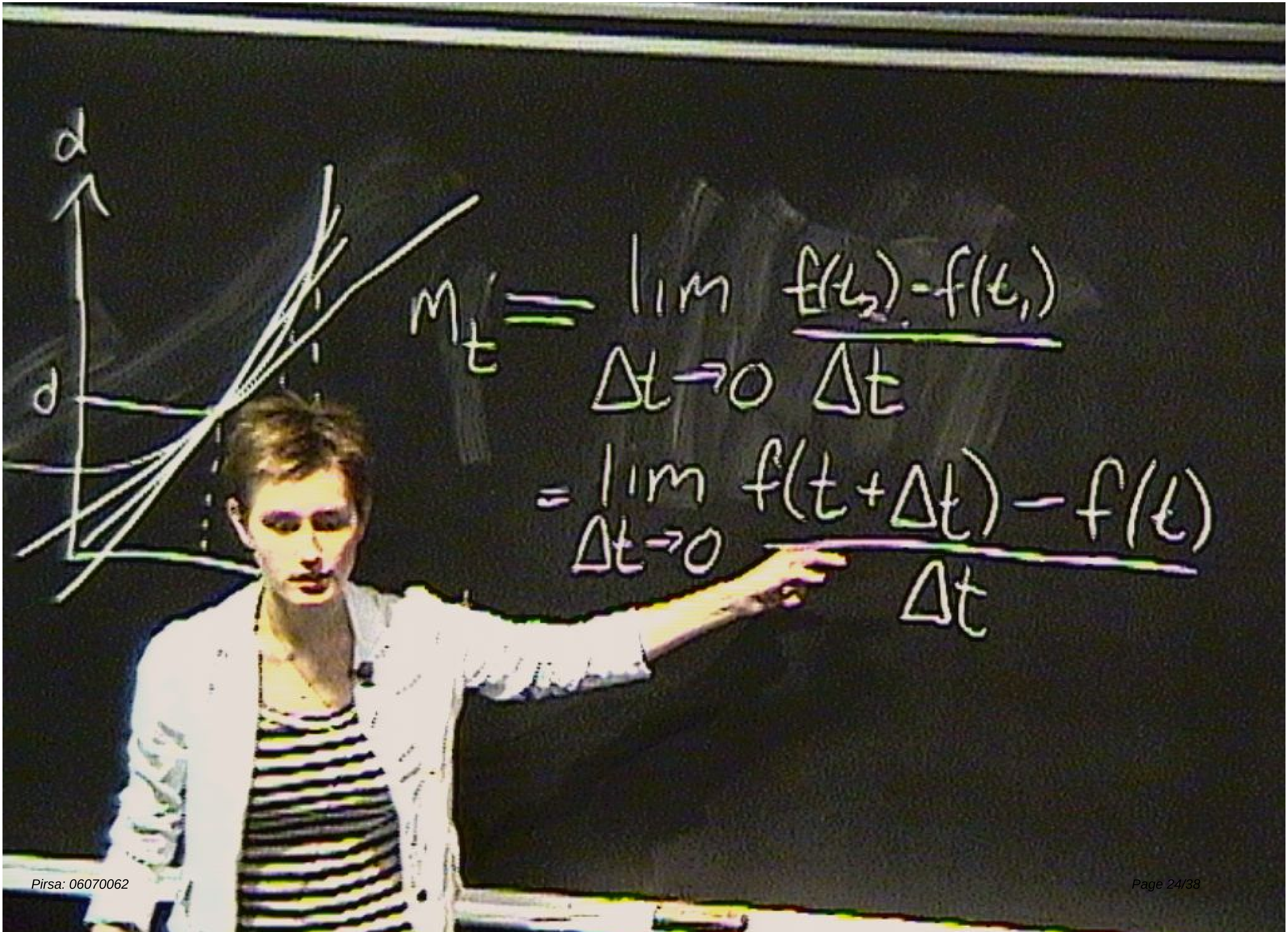
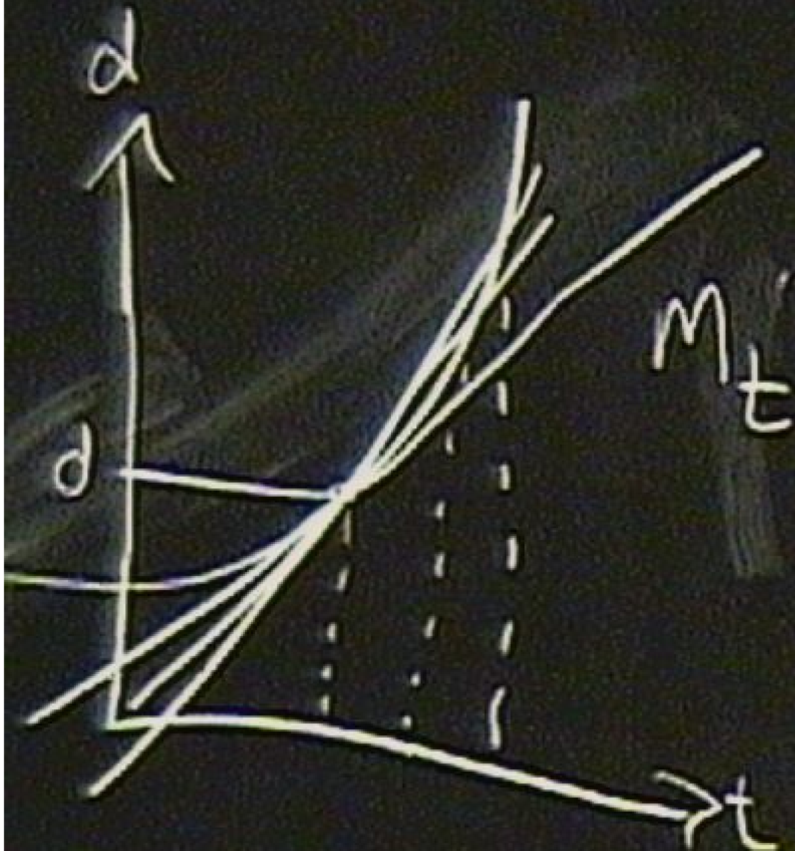

d
d
t
$m_t = \lim_{\Delta t \to 0} \frac{\Delta d}{\Delta t}$


d
d
$m_t = \lim_{\Delta t \to 0} \frac{f(t_2) - f(t_1)}{\Delta t}$
$= \lim_{\Delta t \to 0} \frac{f(t+\Delta t) - f(t)}{\Delta t}$



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$$\frac{df(t)}{dt} = \lim_{\Delta t \to 0} \frac{f(t+\Delta t) - f(t)}{\Delta t}$$

$$= \frac{\Delta y}{\Delta t}$$

$$m_t \equiv \lim_{\Delta t \to 0} \frac{f(t_2) - f(t_1)}{\Delta t}$$

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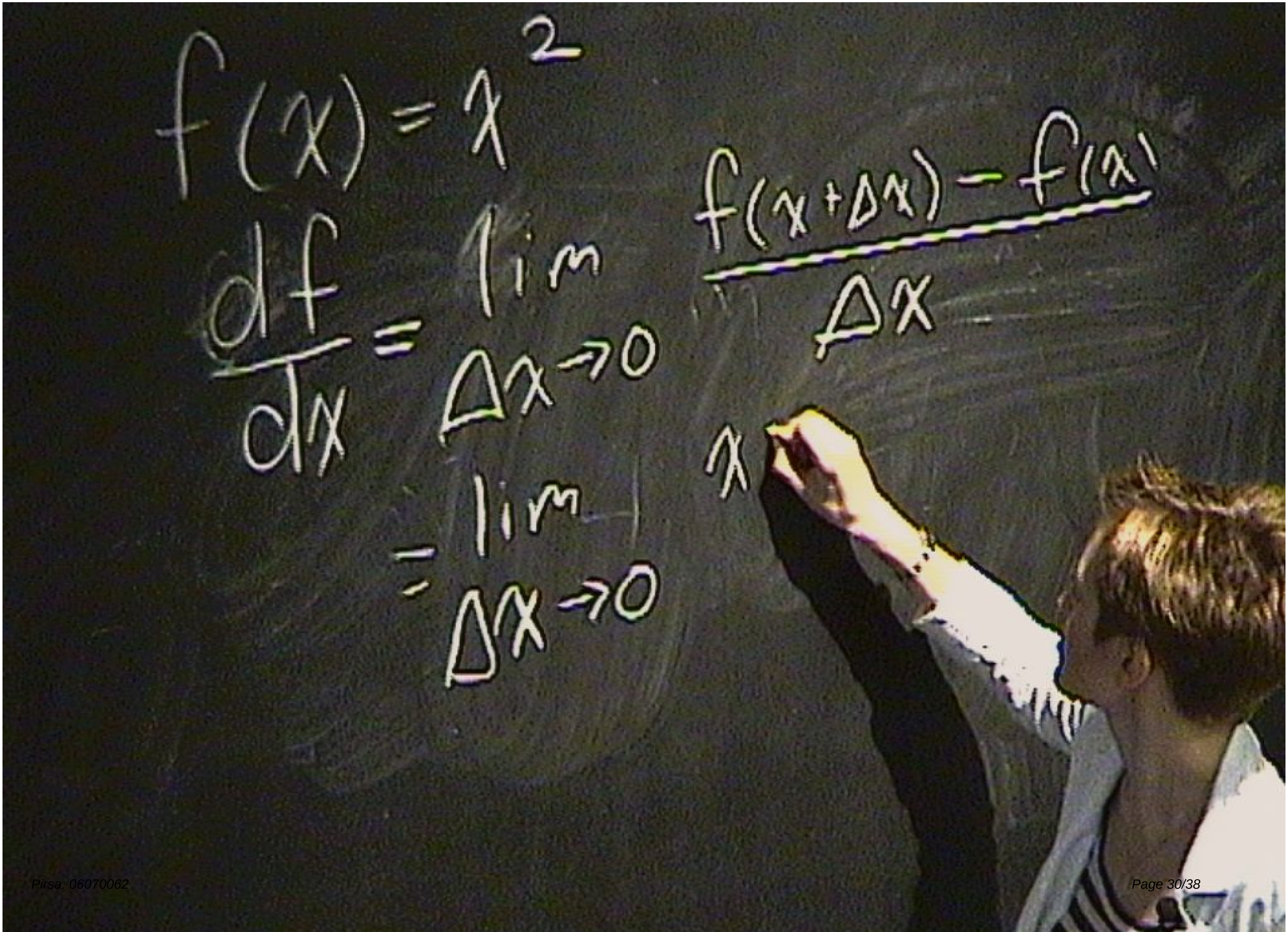
$$f(x) = x^2$$

$$\frac{df}{dx}$$


$f(x) = x^2$
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$= \lim_{\Delta x \to 0}$
x

$$f(x) = x^2$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} (x+\Delta x)^2 - x$$

$$f(x) = x^2$$

$$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \quad (x+\Delta x)^2 - x^2$$

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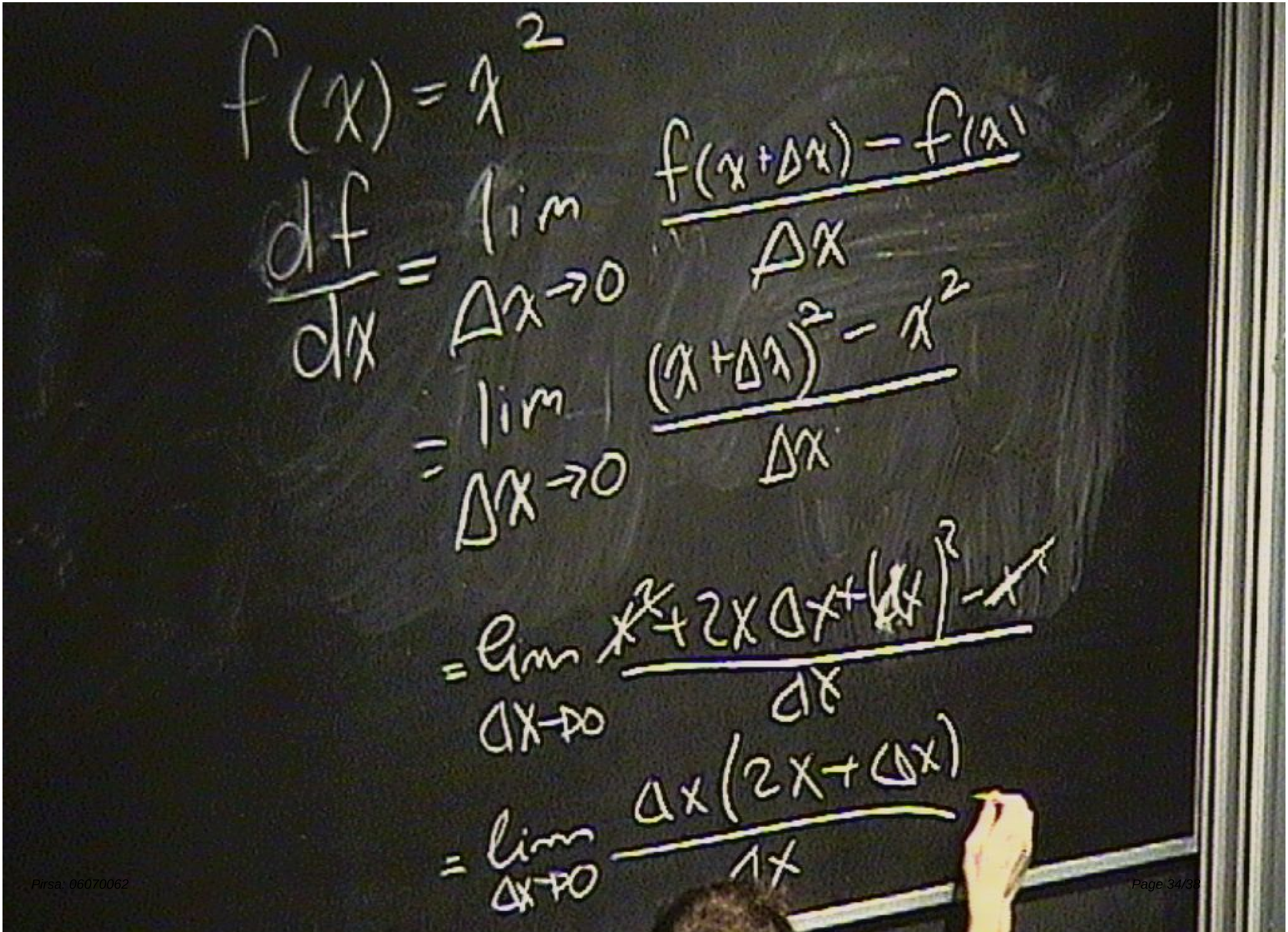
$$= \lim_{\Delta x \to 0} \frac{(x+\Delta x)^2 - x^2}{\Delta x}$$



$f(x) = x^2$
$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$
$= \lim_{\Delta x \to 0} \frac{(x+\Delta x)^2 - x^2}{\Delta x}$
$= \lim_{\Delta x \to 0} \frac{\cancel{x^2} + 2x\Delta x + (\Delta x)^2 - \cancel{x^2}}{\Delta x}$
$= \lim_{\Delta x \to 0} \frac{\Delta x(2x + \Delta x)}{\Delta x}$

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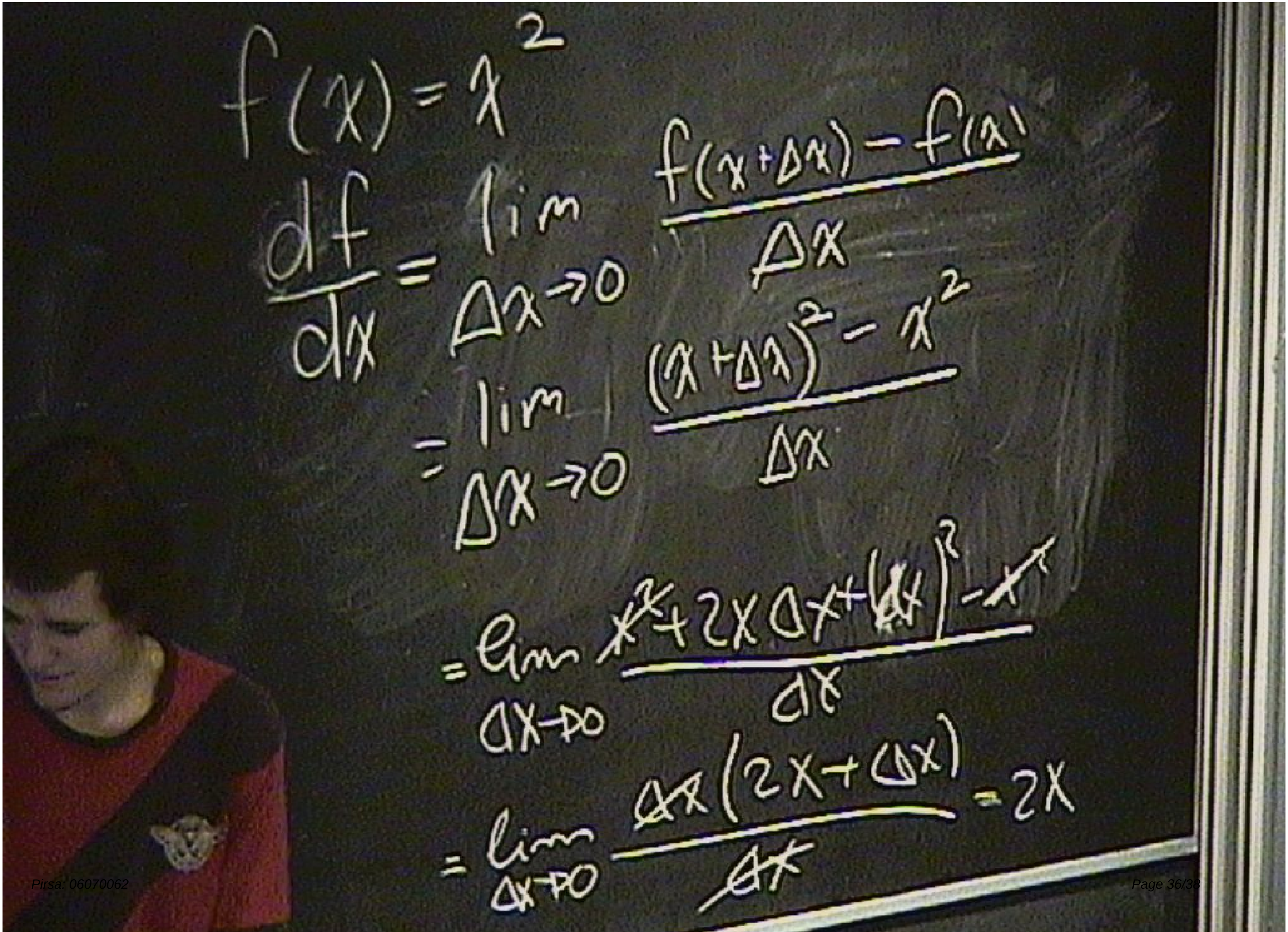
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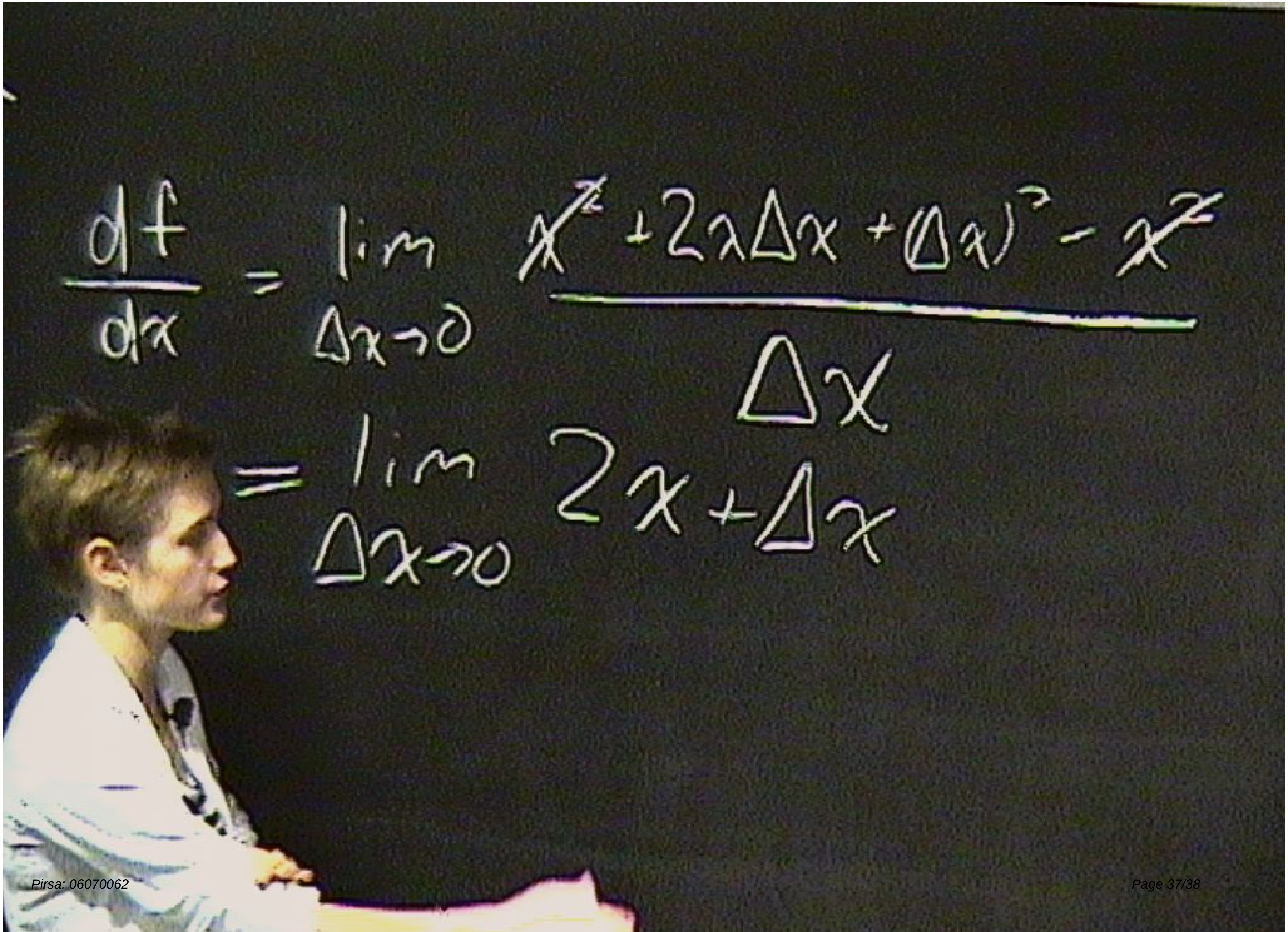
$= \lim_{\Delta x \to 0} \frac{\cancel{\Delta x}(2x + \Delta x)}{\cancel{\Delta x}} = 2x$



$\frac{df}{dx} = \lim_{\Delta x \to 0} \frac{\cancel{x^2} + 2x\Delta x + (\Delta x)^2 - \cancel{x^2}}{\Delta x}$
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$$= \lim_{\Delta x \to 0} 2x + \Delta x$$

$$= 2x$$