Title: Math Primer: More Differentiation

Date: Jul 24, 2006 01:00 PM

URL: http://pirsa.org/06070064

Abstract:

CAUTION

CAUTION

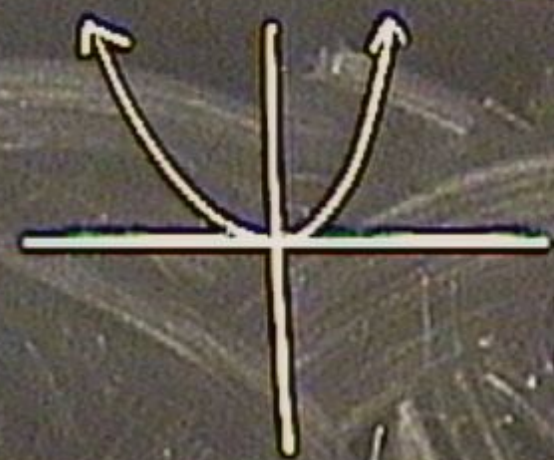
GROK

GROK

$$y = x^2$$

GROK

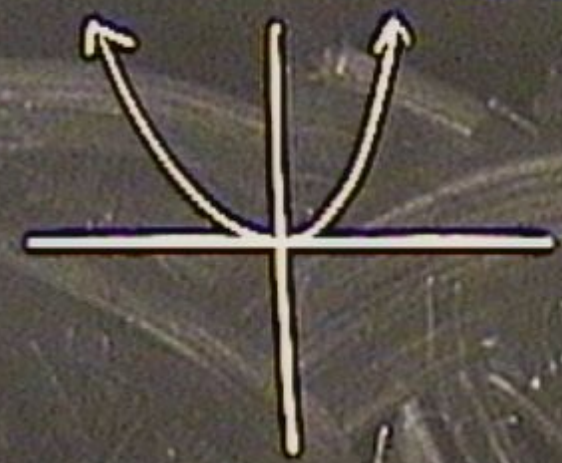
$$y = x^2$$



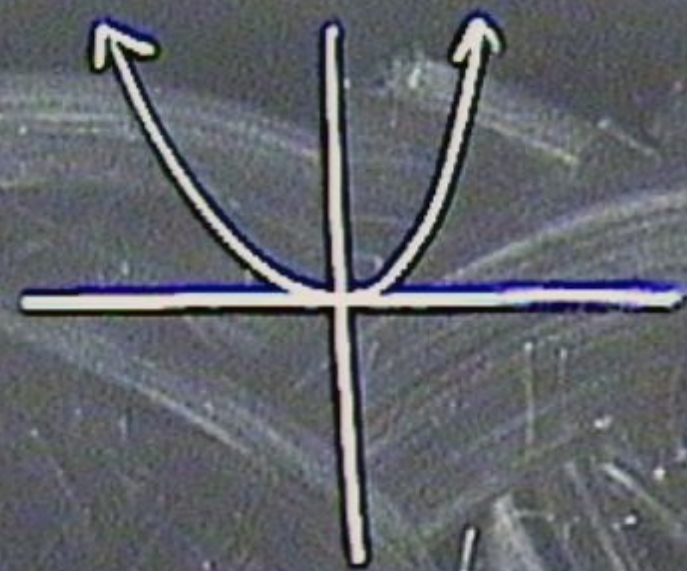
GROK

$$y = x^2$$

$$y = S(x) = x^2$$



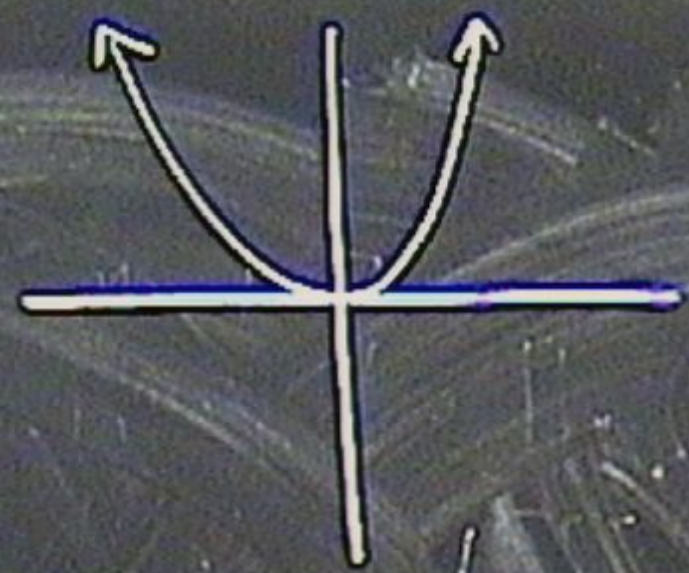
$$y = x^2$$



$$y = S(x) = x^2$$

$$S(\text{turtle}) = \text{turtle}^2$$

$$y = x^2$$

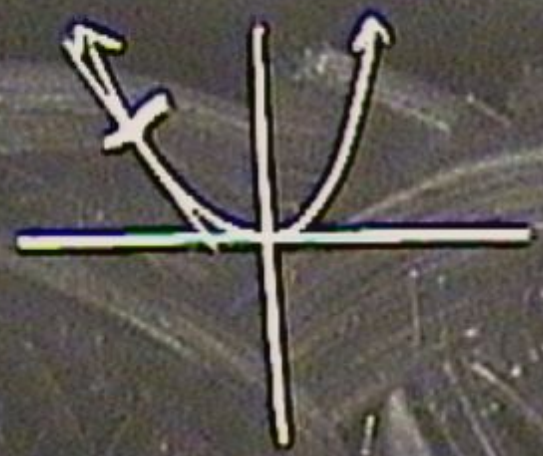


$$y = f(x) = x^2$$

$$f(\text{☺}) = \text{☺}^2$$

$$f(x+1) = (x+1)^2$$

$y = x^2$



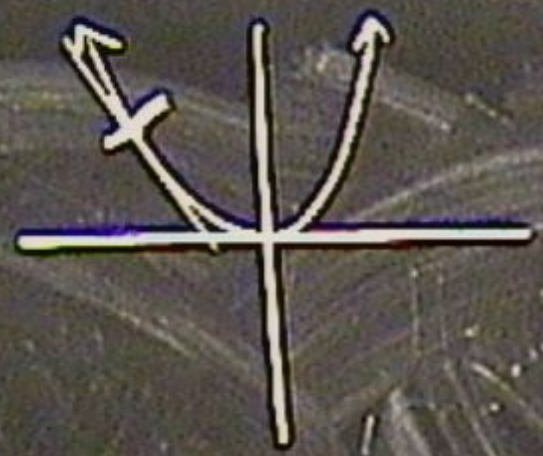
$y = -2x + 4$

$S(x) = x^2$

$S(\text{☺}) = \text{☺}^2$

$S(x+1) = (x+1)^2$

$y = x^2$



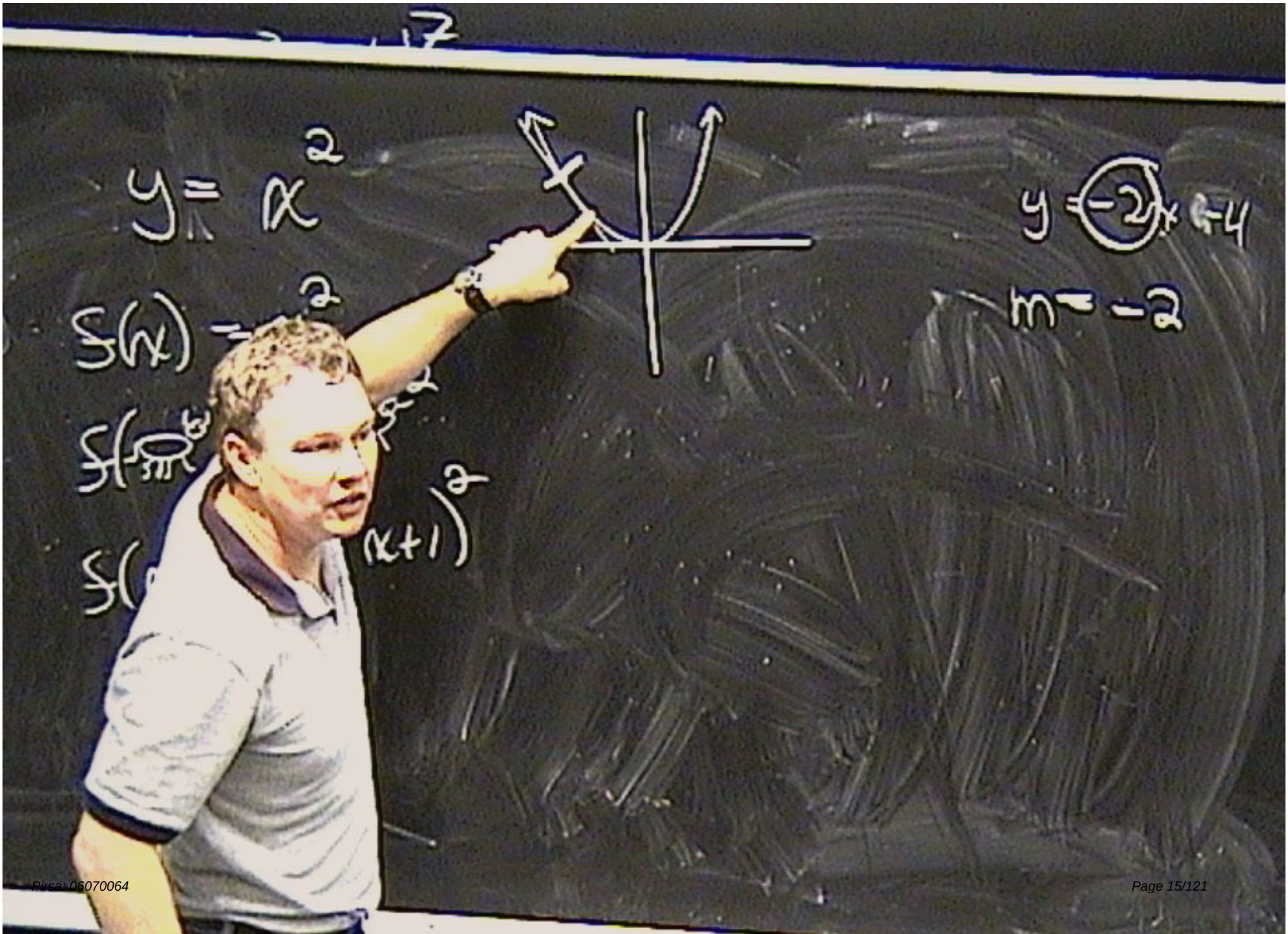
$y = -2x - 4$

$m = -2$

$S(x) = x^2$

$S(\text{☠}) = \text{☠}^2$

$S(x+1) = (x+1)^2$


y = x^2
y = -2x + 4
m = -2

$y = x^2$

$y = -2x + 4$

$m = -2$

$S(x) = x^2$

$S(\text{[illegible]}) = \text{[illegible]}^2$

$S(x+1) = (x+1)^2$

$y = x^2$

$y = -2x - 4$

$m = -2$

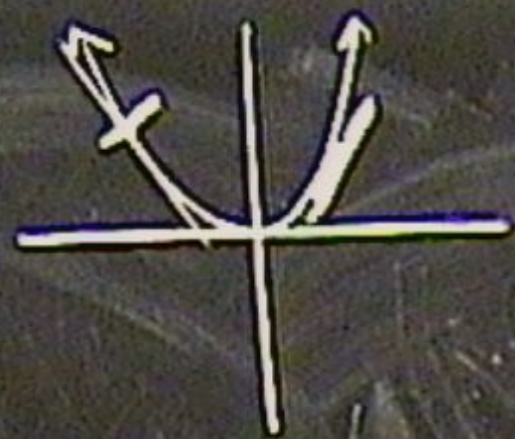
$f(x) = x^2$

$f(\text{[illegible]}) = \text{[illegible]}^2$

$f(x+1) = (x+1)^2$

$m = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

$y = x^2$



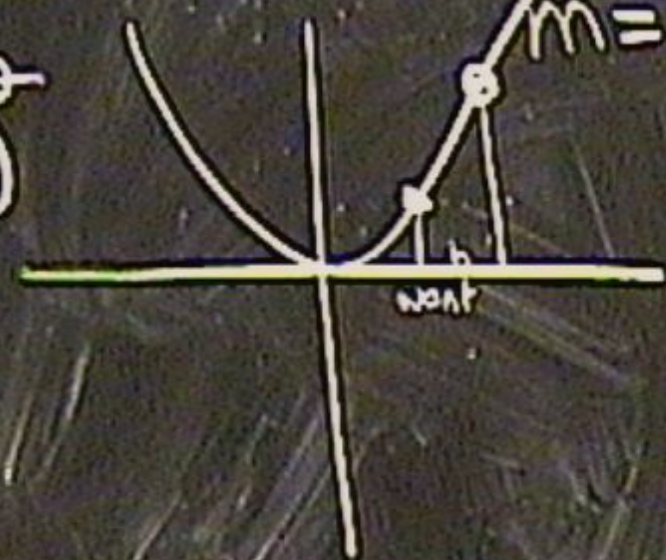
$y = -2x + 4$

$m = -2$

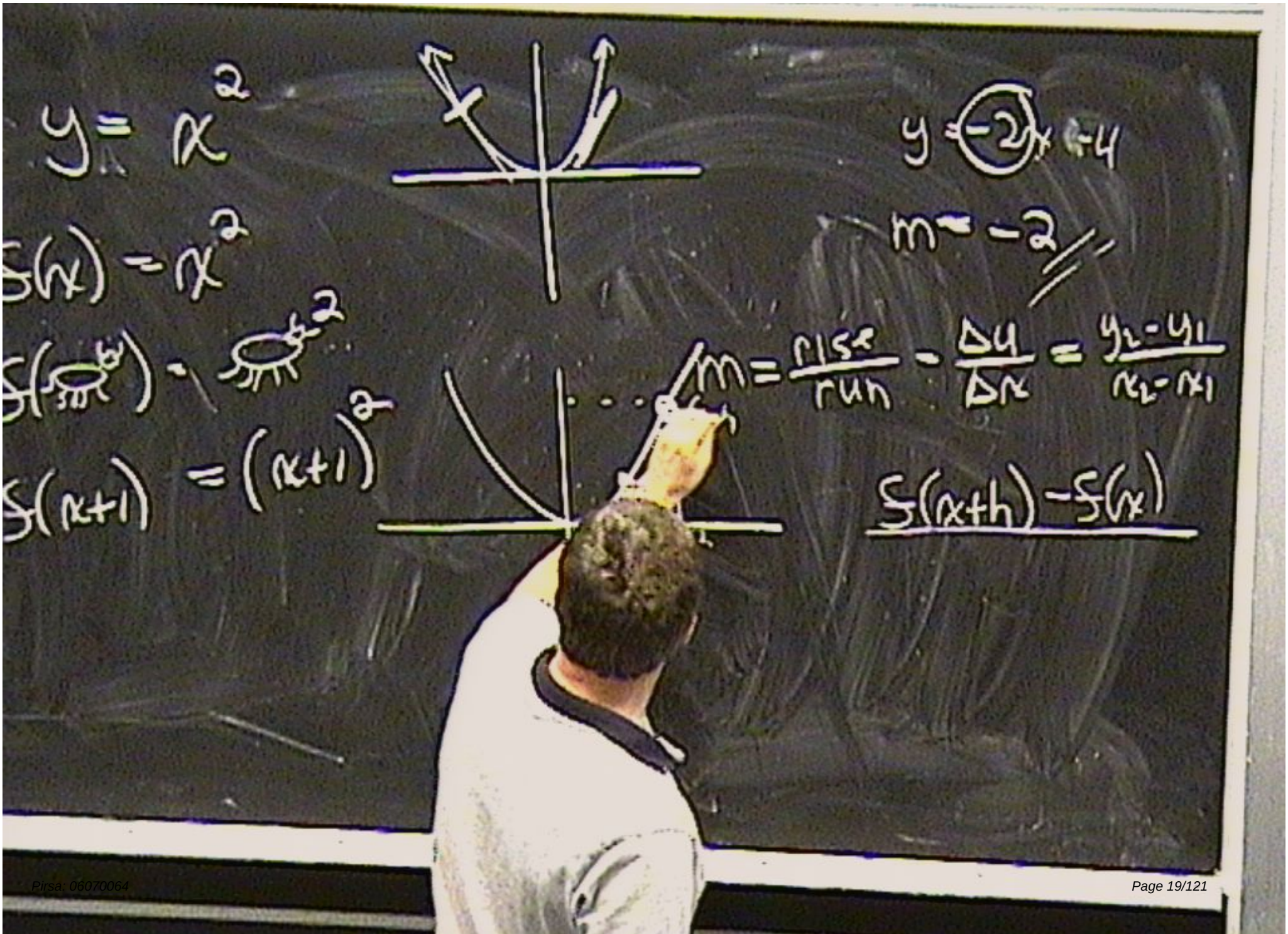
$f(x) = x^2$

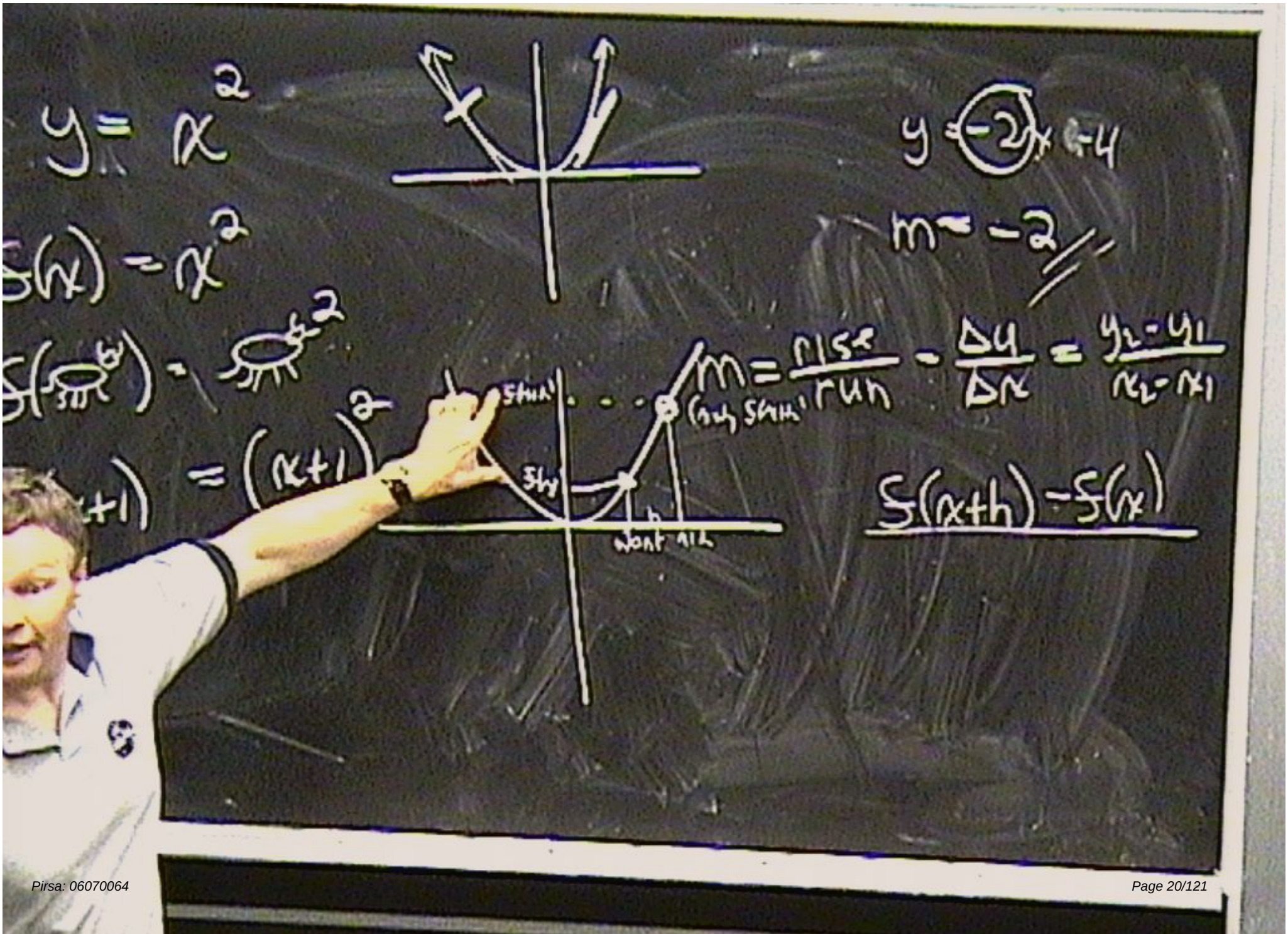
$f(\text{☺}) = \text{☺}^2$

$f(x+1) = (x+1)^2$



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


y = x^2
f(x) = x^2
f(x+1) = (x+1)^2
y = -2x + 4
m = -2
m = rise/run = Δy/Δx = (y2 - y1)/(x2 - x1)
(f(x+h) - f(x))


y = x^2
f(x) = x^2
(x+1) = (x+1)^2
y = -2x + 4
m = -2
m = rise / run = Δy / Δx = (y2 - y1) / (x2 - x1)
f(x+h) - f(x)

$y = x^2$

$y = -2x + 4$

$m = -2$

$f(x) = x^2$

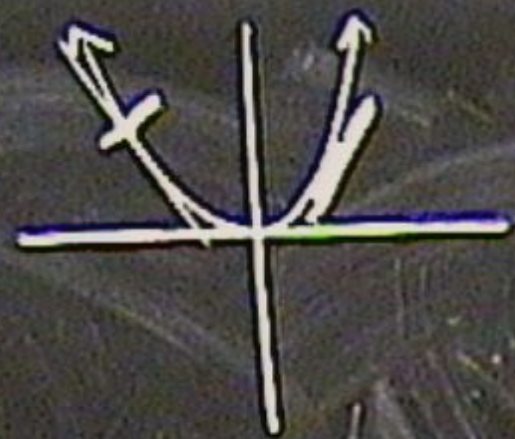
$f(\text{[illegible]}) = \text{[illegible]}^2$

$f(x+1) = (x+1)^2$

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

$\frac{f(x+h) - f(x)}{x+h - x}$

$y = x^2$



$y = -2x + 4$

$m = -2$

$f(x) = x^2$

$f(\text{bug}) = \text{bug}^2$

$f(x+1) = (x+1)^2$

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

$\frac{f(x+h) - f(x)}{h}$

$y = x^2$

$y = -2x + 4$

$m = -2$

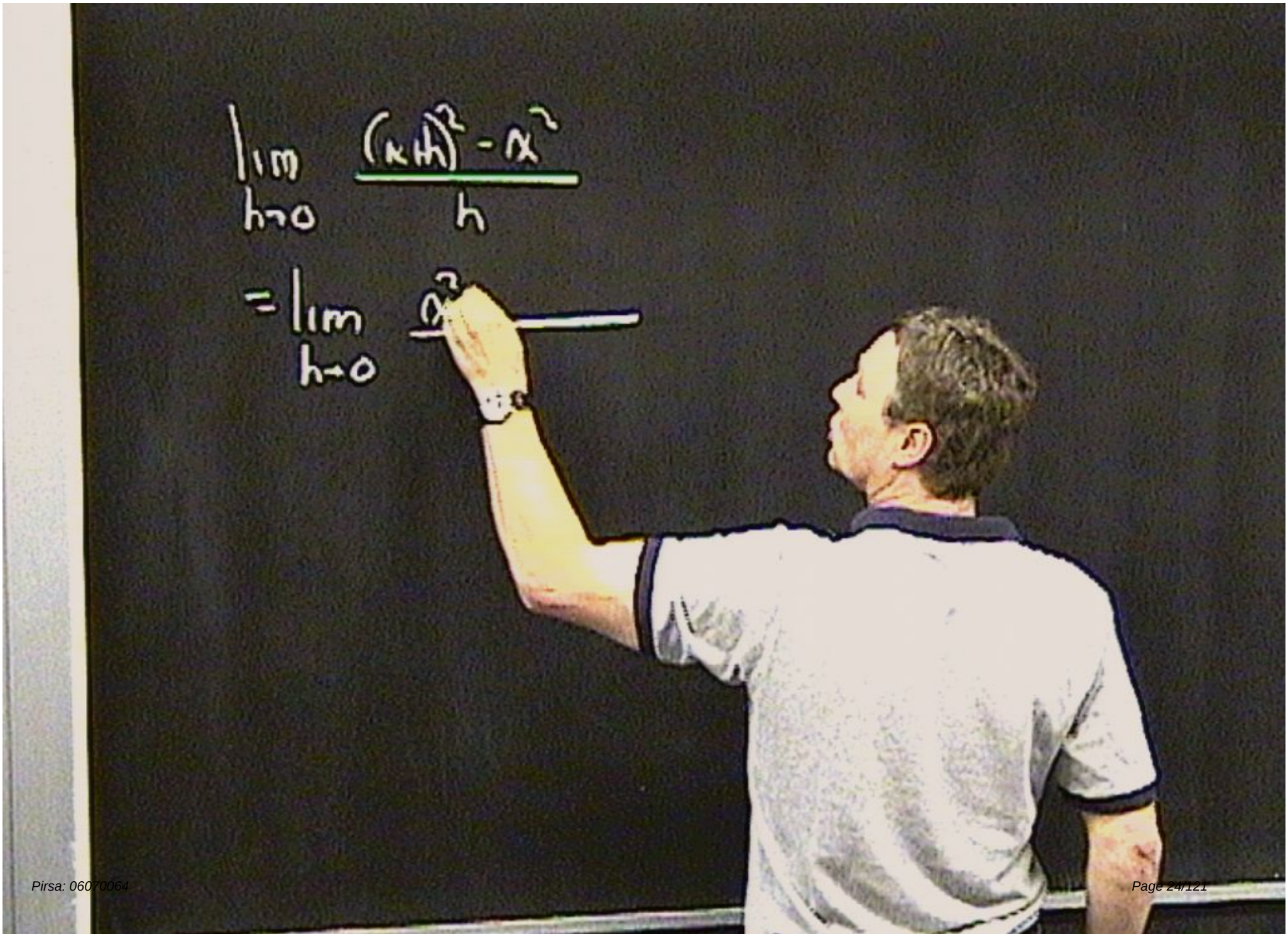
$f(x) = x^2$

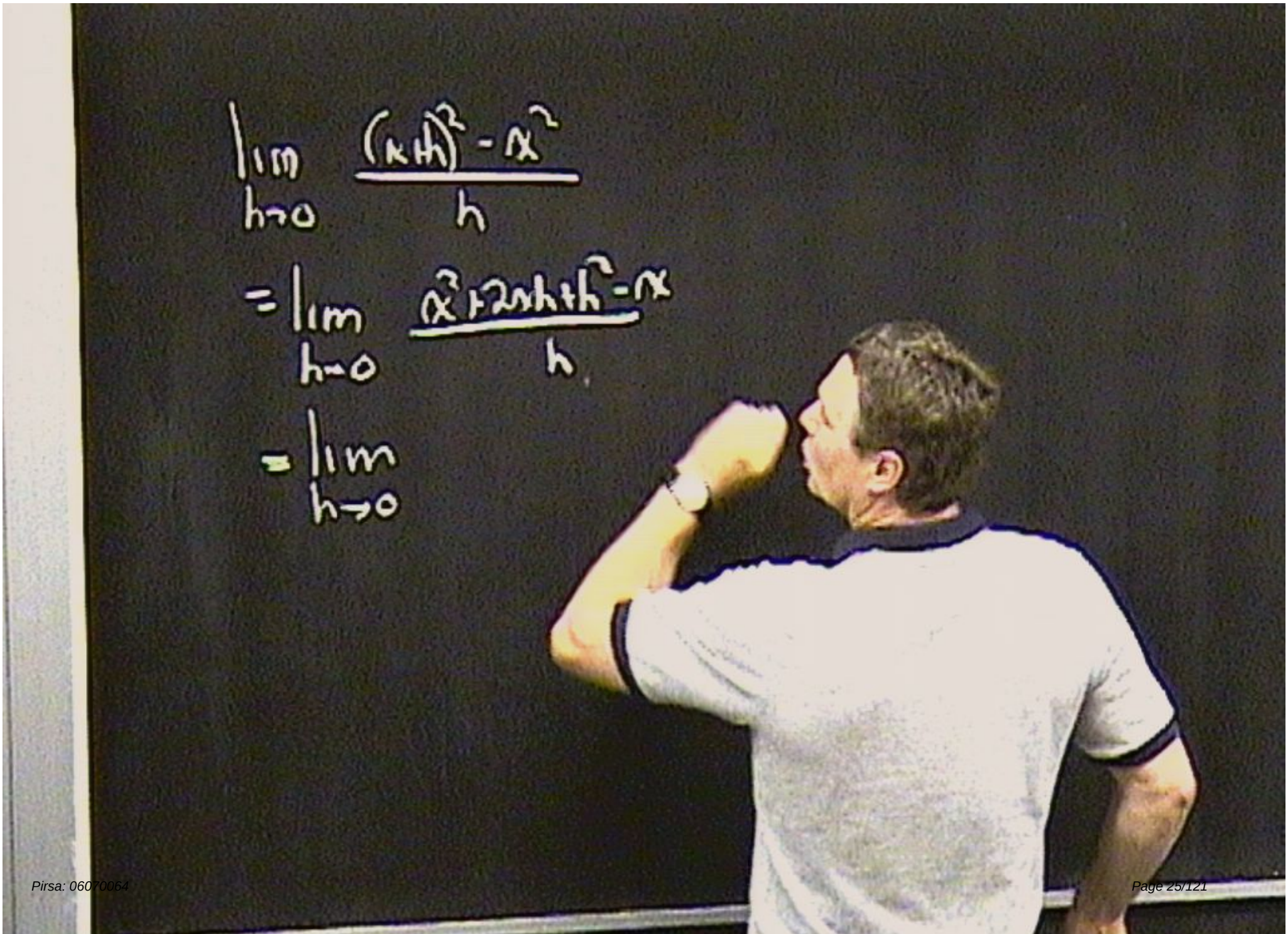
$f(\text{☺}) = \text{☺}^2$

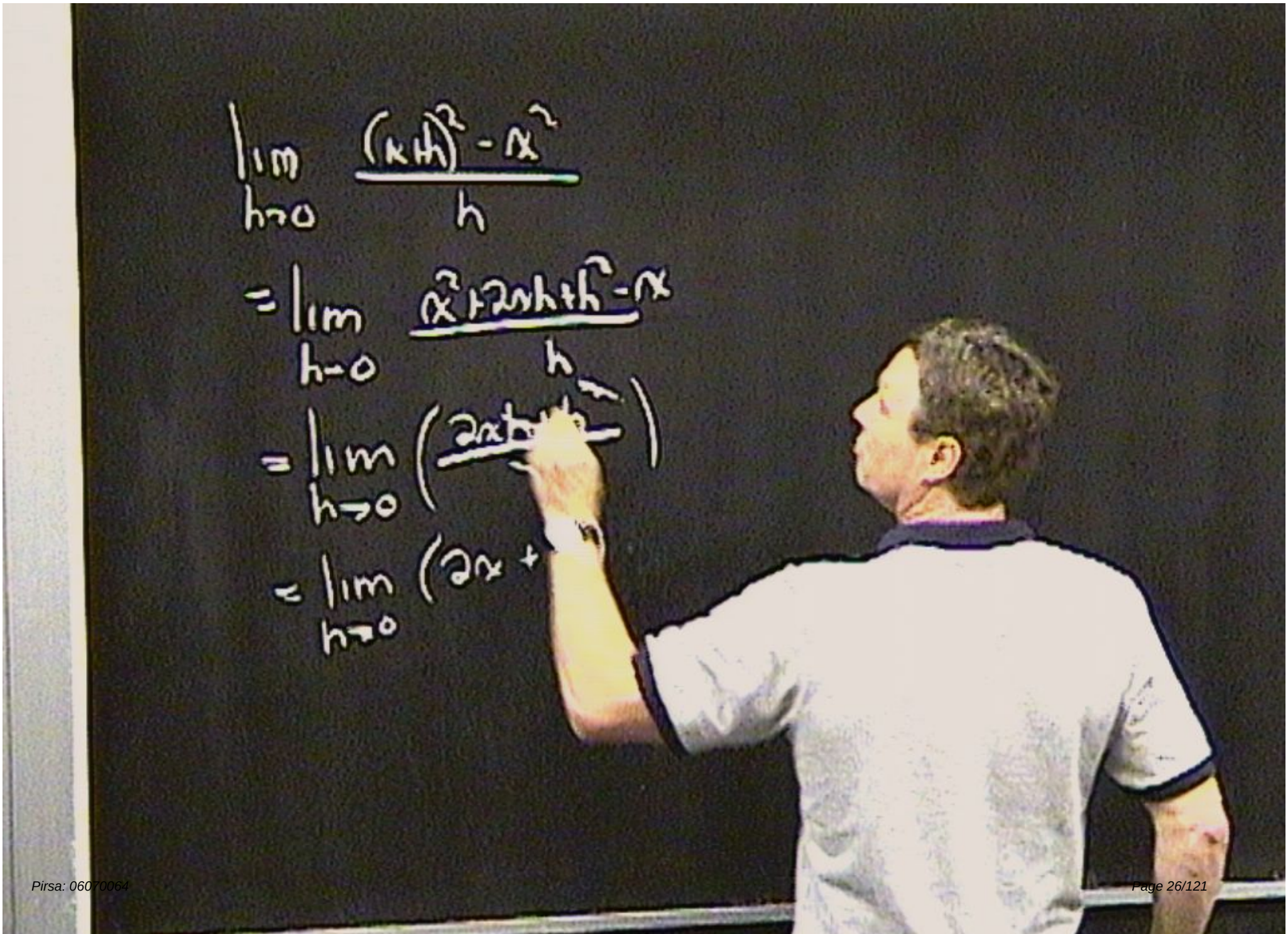
$f(x+1) = (x+1)^2$

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

$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$


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


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


$\lim_{h\to 0} \frac{(x+h)^2 - x^2}{h}$
$= \lim_{h\to 0} \frac{x^2+2xh+h^2-x}{h}$
$= \lim_{h\to 0} \left(\frac{2xh+h^2}{h}\right)$
$= \lim_{h\to 0} (2x +$

$$\lim_{h\to 0}\left(\frac{(x+h)^2 - x^2}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{x^2+2xh+h^2-x^2}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{2xh+h^2}{h}\right)$$

$$= \lim_{h\to 0}\left(2x+h\right)$$

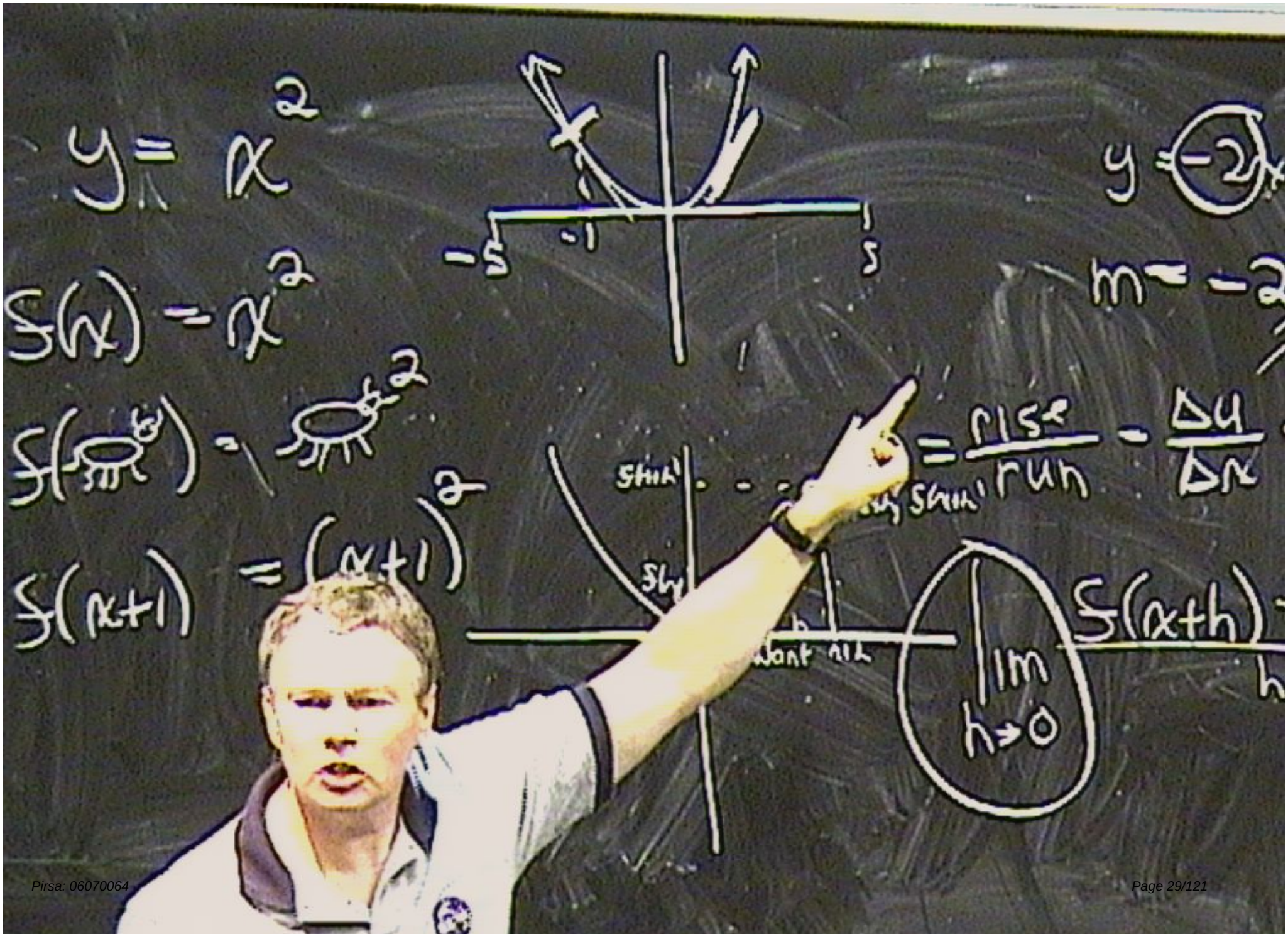
$$\lim_{h\to 0}\left(\frac{(x+h)^2 - x^2}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{x^2 + 2xh + h^2 - x^2}{h}\right)$$

$$= \lim_{h\to 0}\left(\frac{2xh + h^2}{h}\right)$$

$$= \lim_{h\to 0}(2x + h)$$

$$= 2x$$

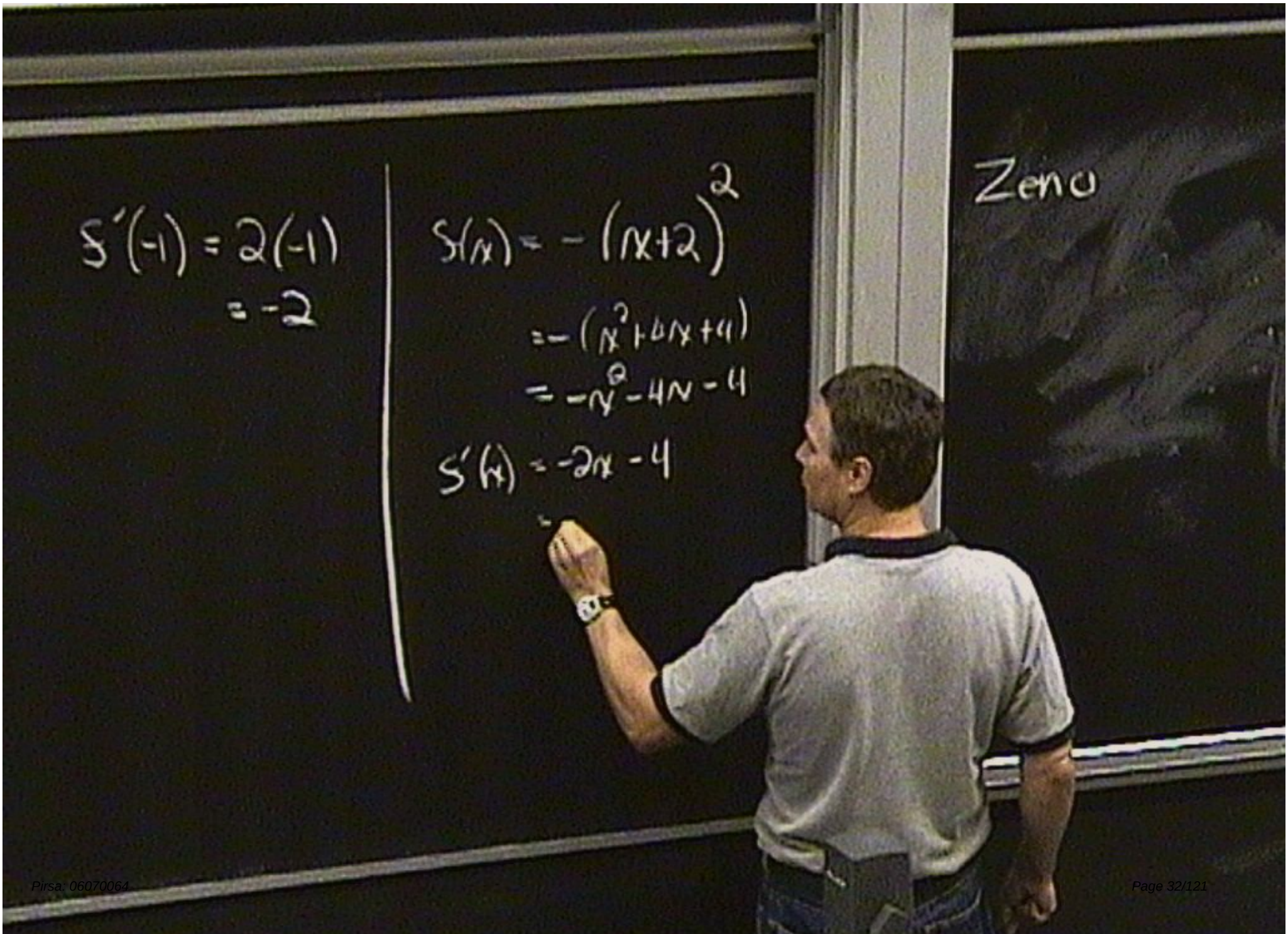

y = x^2
f(x) = x^2
f(x+1) = (x+1)^2
-5
-1
5
y = -2
m = -2
= rise / run = Δy / Δx
lim h→0
f(x+h)

$$f'(-1) = 2(-1)$$
$$= -2$$

$f(x) =$

$$S'(-1) = 2(-1)$$
$$= -2$$

$$S(x) = -(x+2)^2$$


$S'(-1) = 2(-1)$
$= -2$
$S(x) = -(x+2)^2$
$= -(x^2+4x+4)$
$= -x^2-4x-4$
$S'(x) = -2x-4$
Zeno

(-1)

-2

$$S(x) = -(x+2)^2$$

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

$$= -x^2-4x-4$$

$$S'(x) = -2x-4$$

$$= -2(x+2)$$

Zeno

$$S'(y) = 0$$

$$0 = -2(y+2)$$

or $\quad y = -2$

Zero

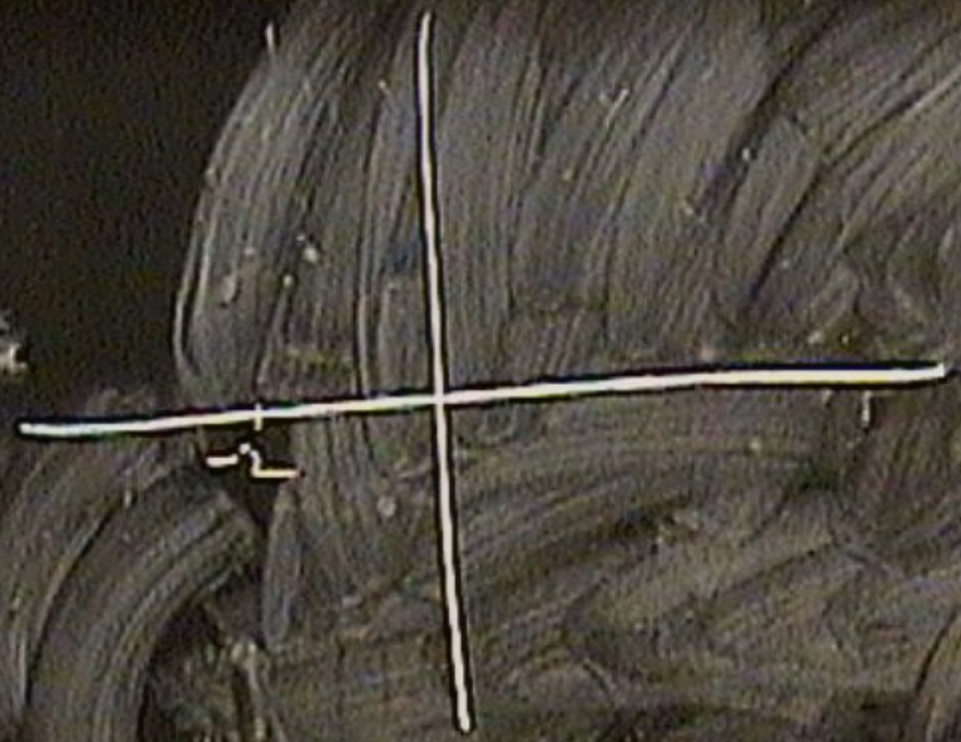
$f'(x) = 0$

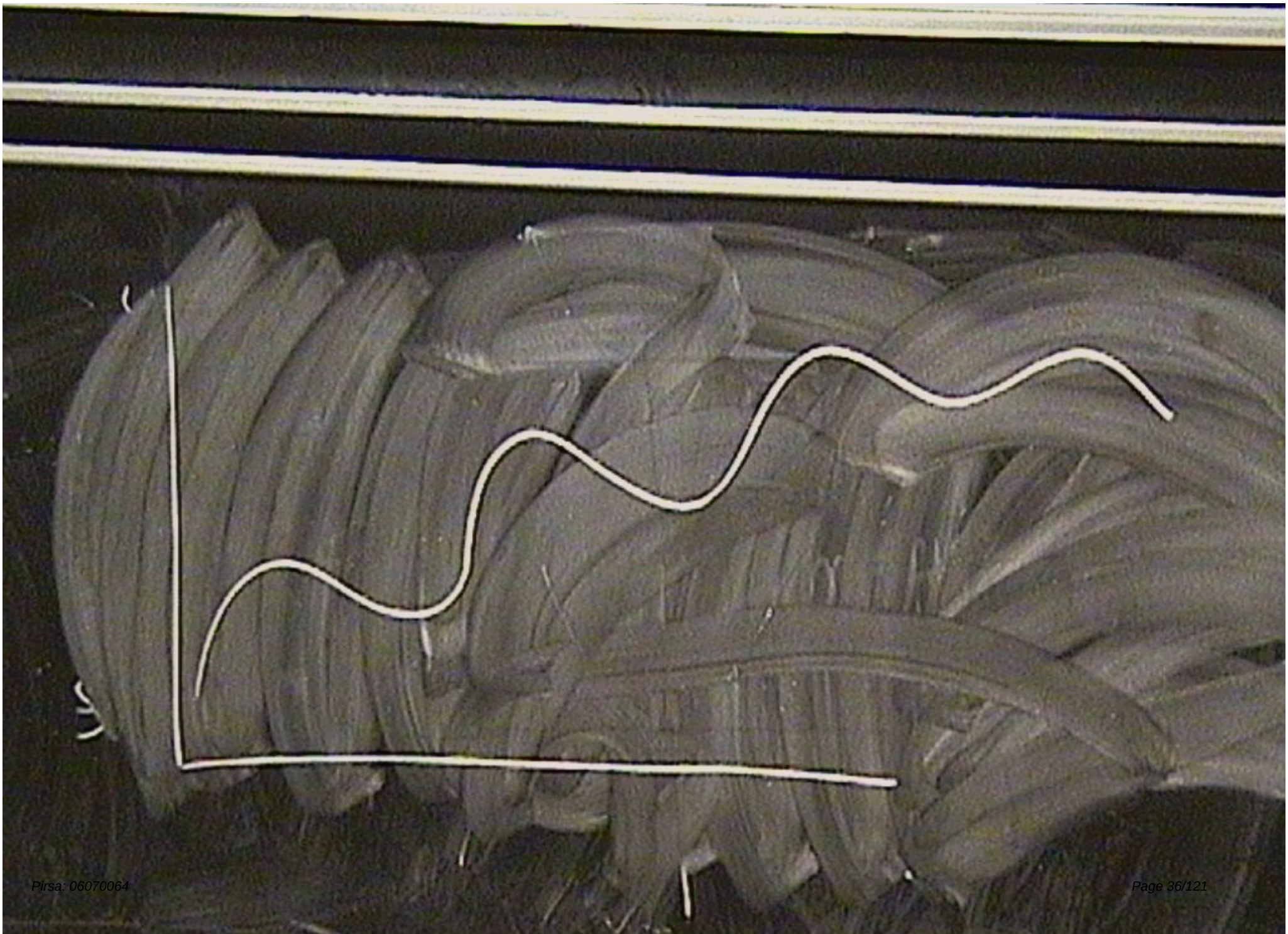
$0 = -2(x+2)$

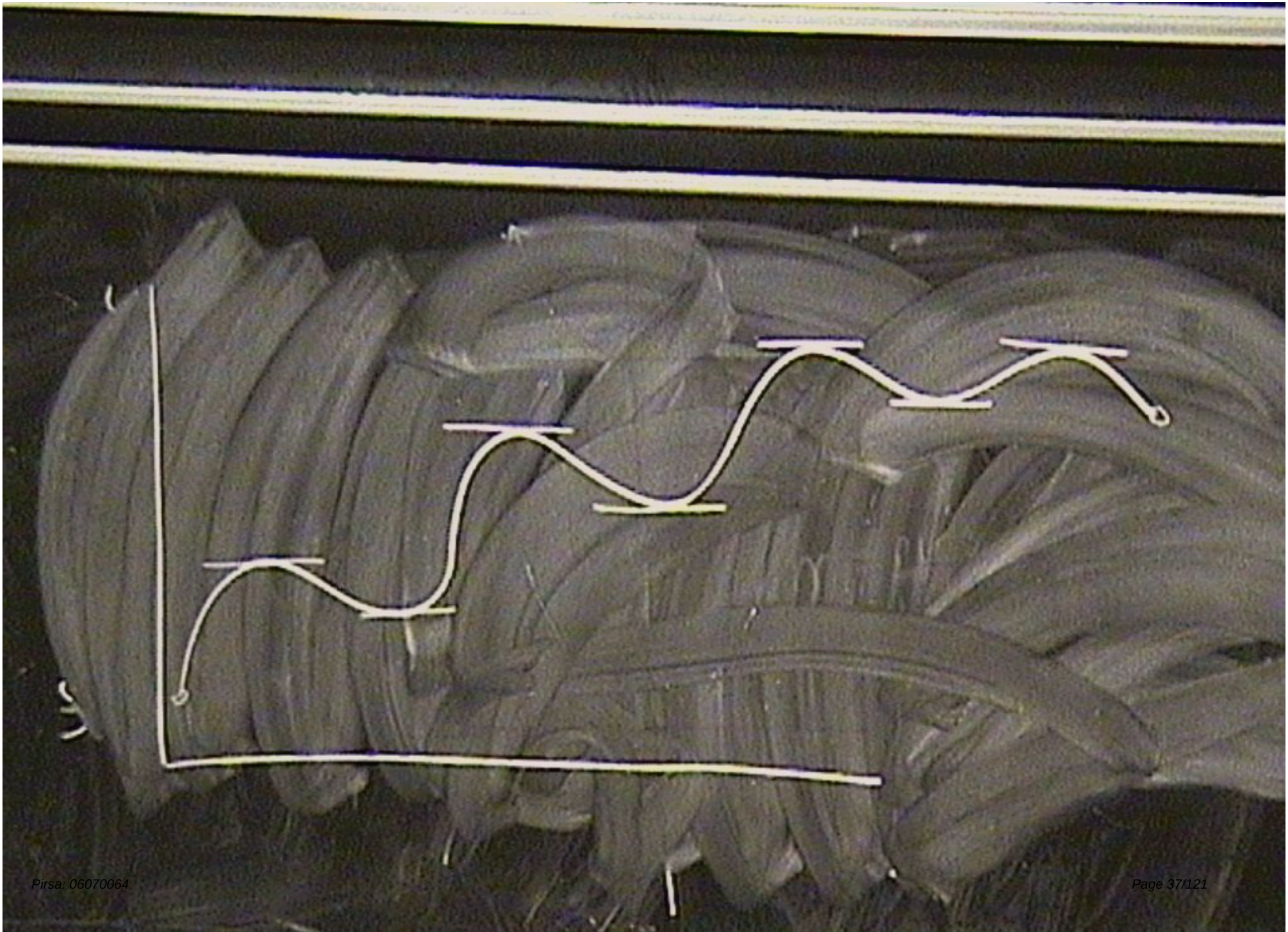
or $x = -2$

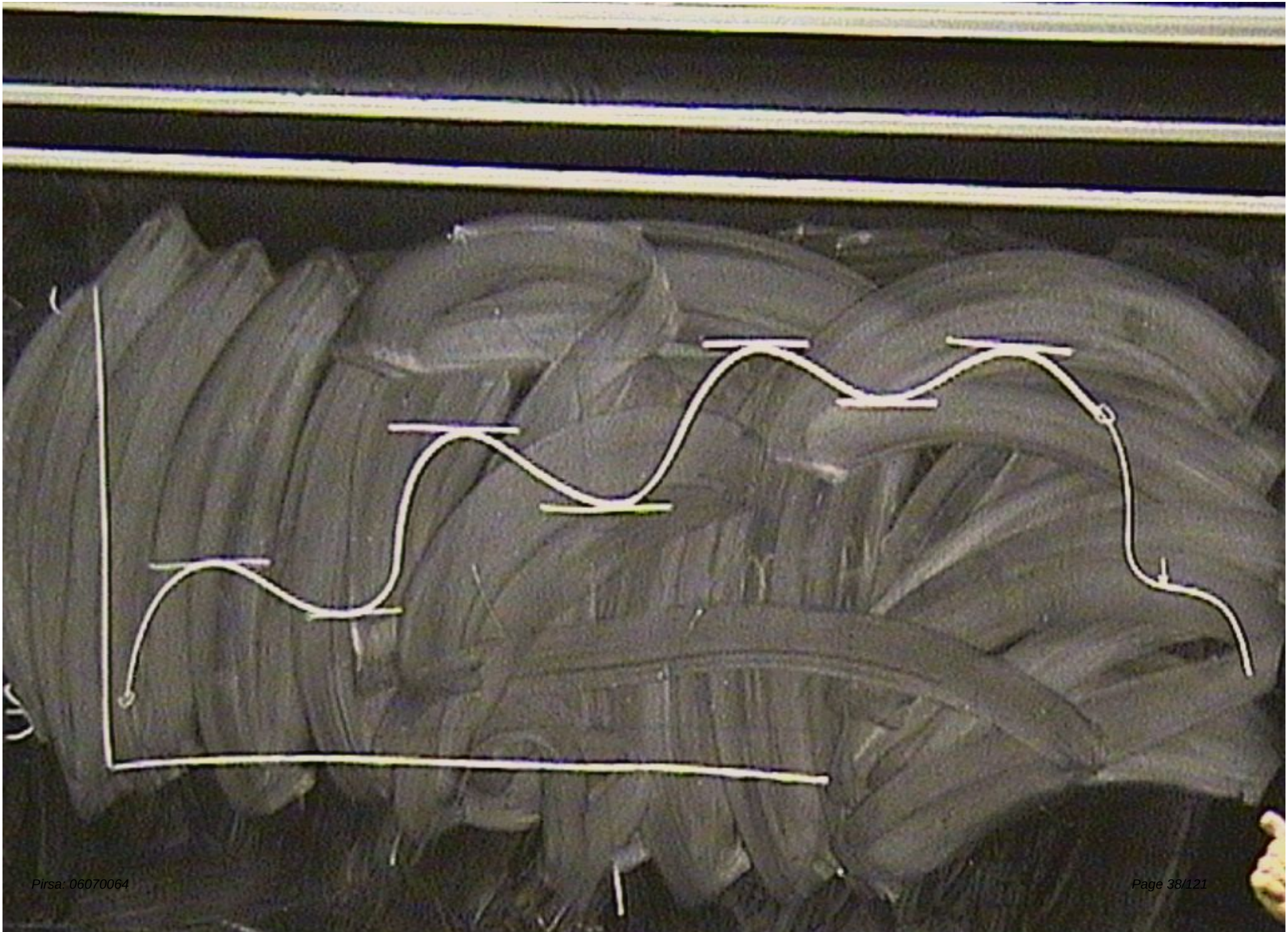
$f(-2) = (0)$

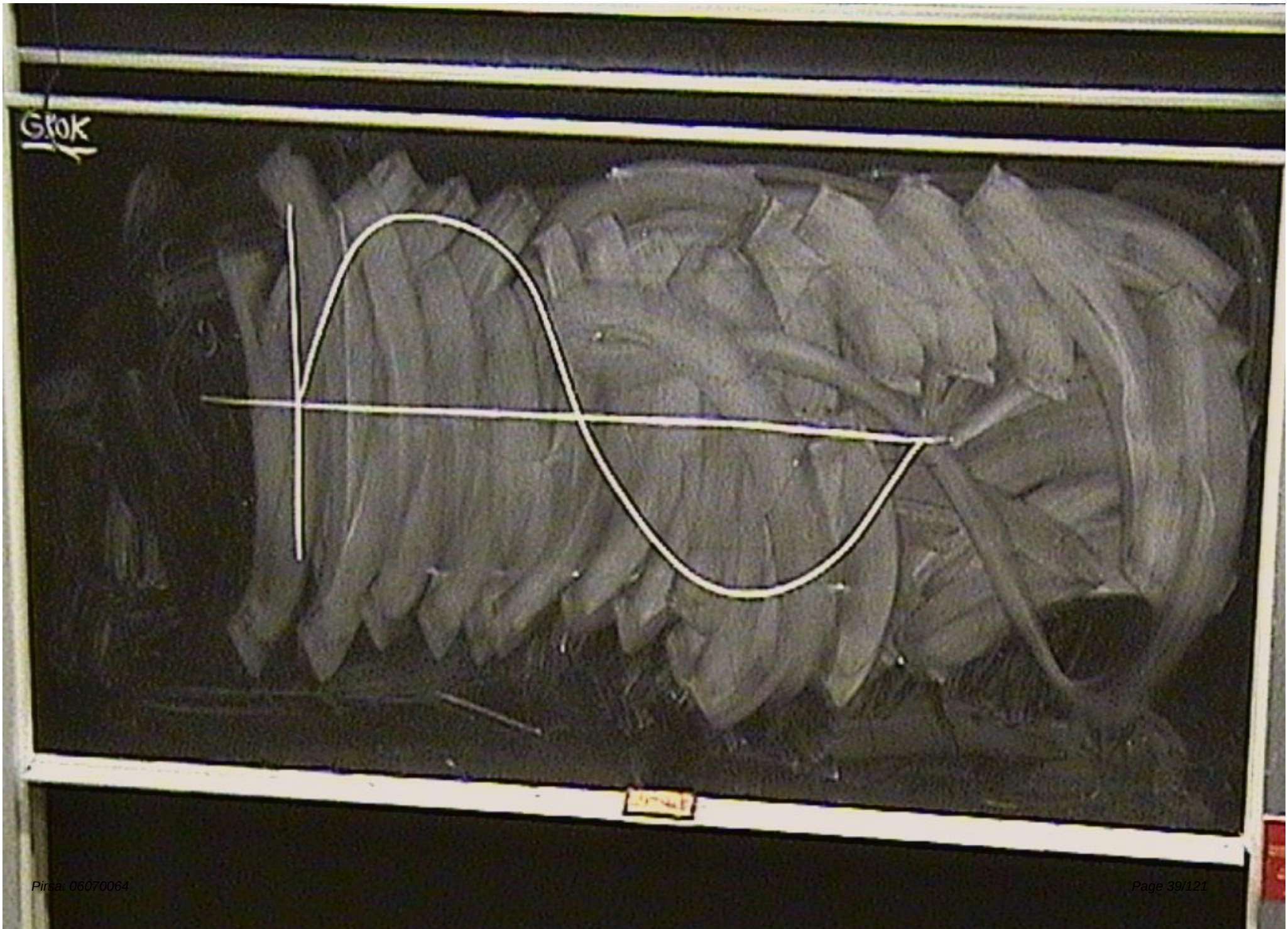
$(-2, 0)$

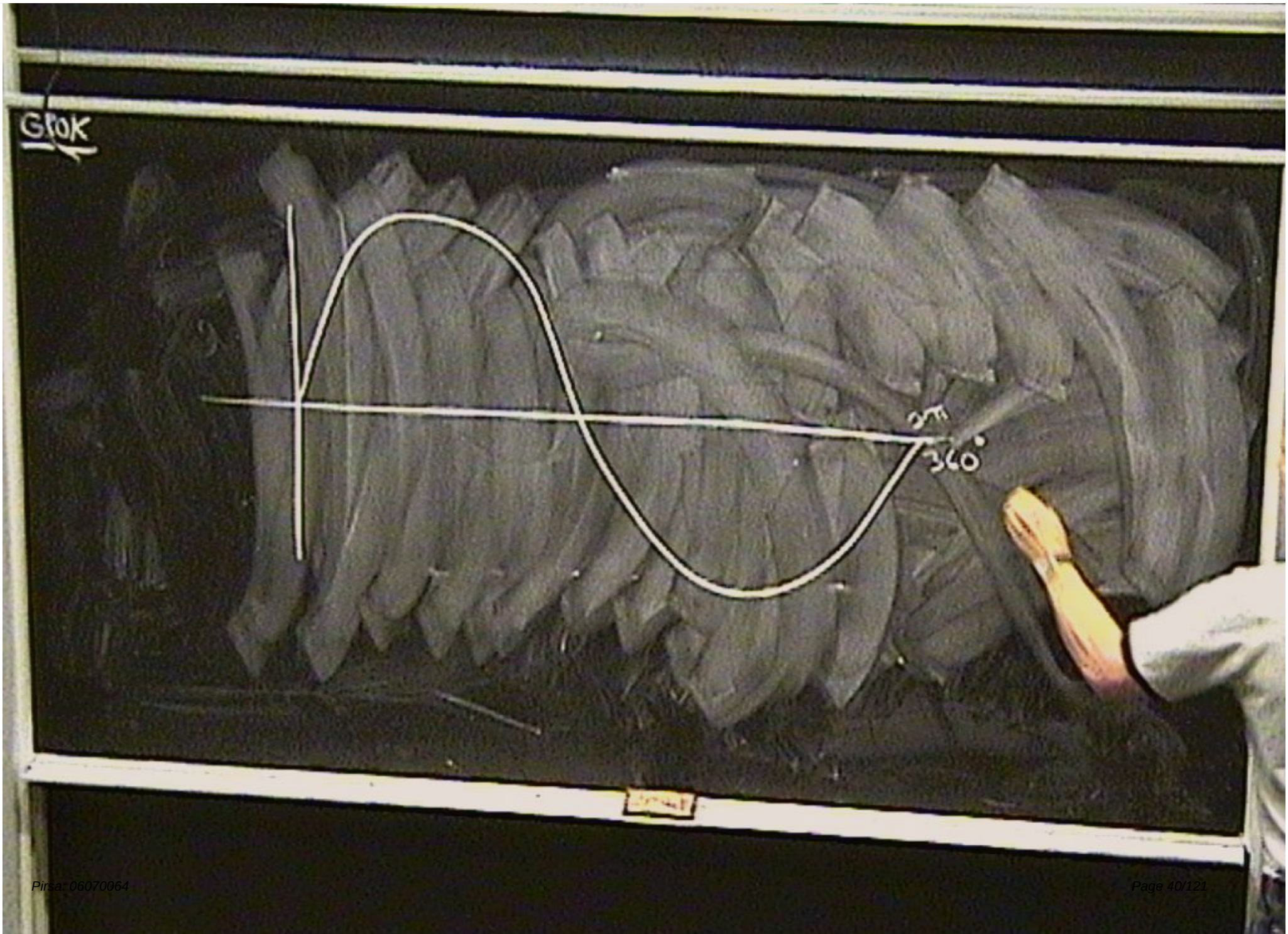


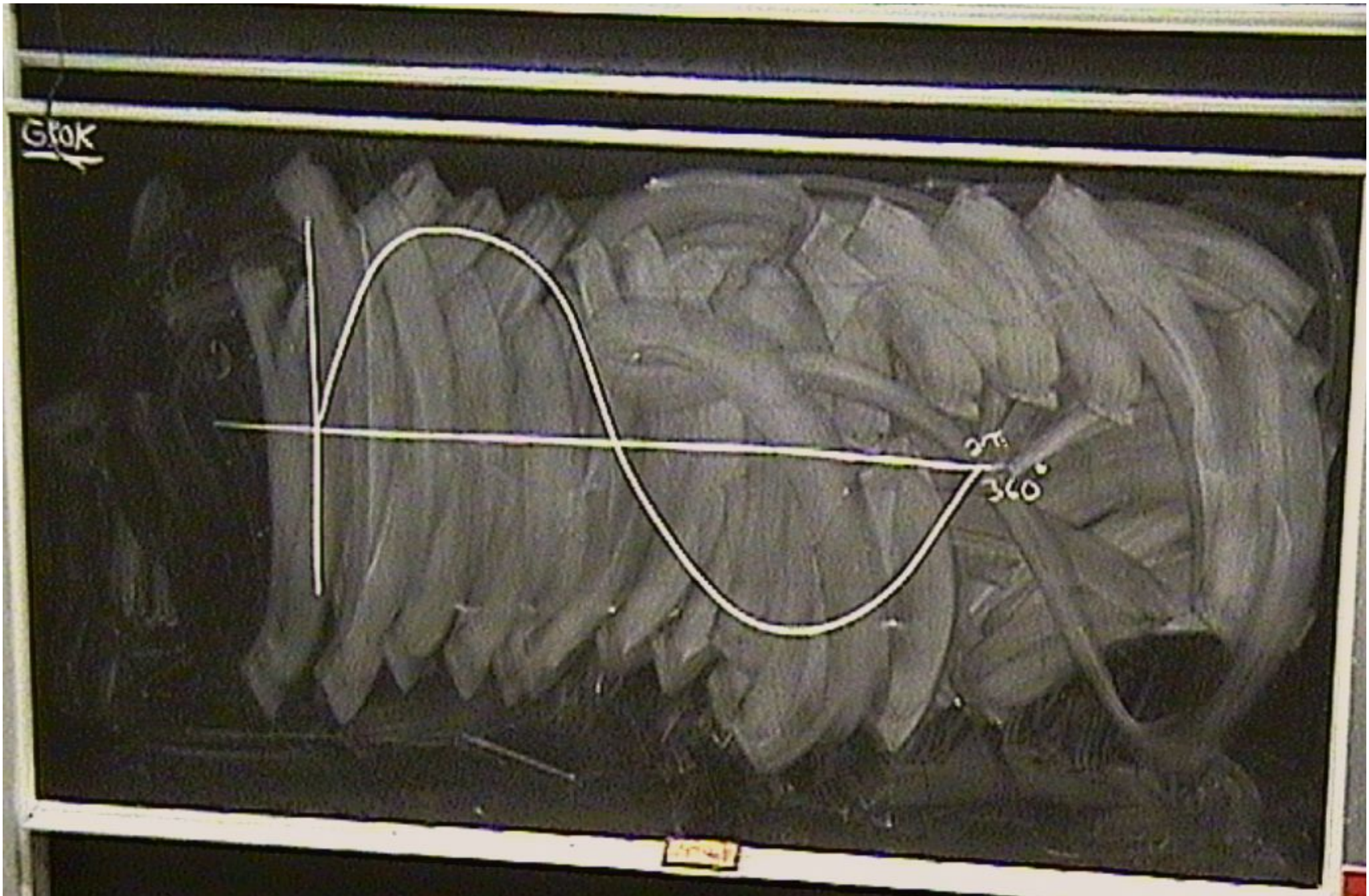


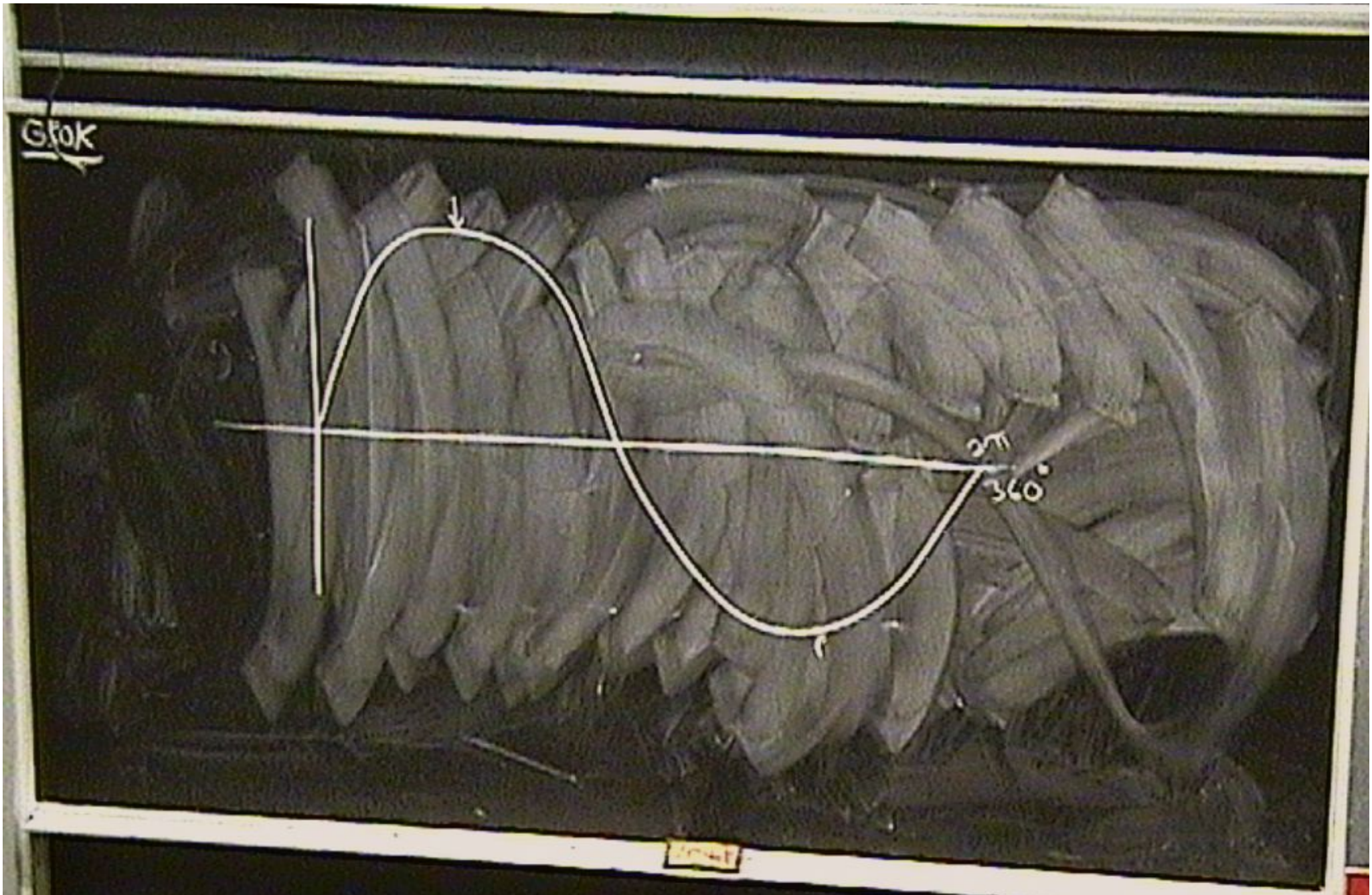





GROK


GROK
2π
360°


GTOK
2π
360°

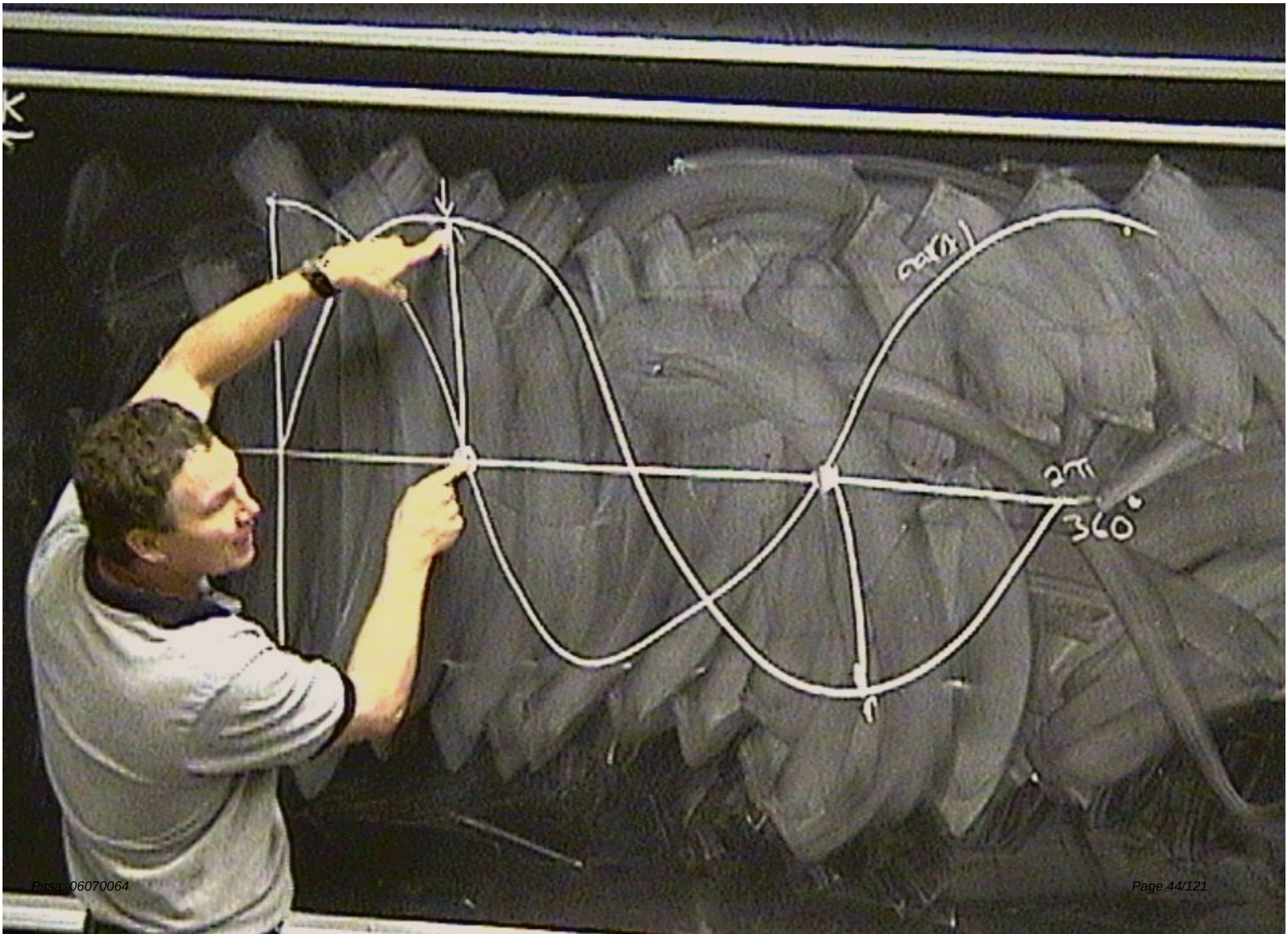

Gfok
2π
360°

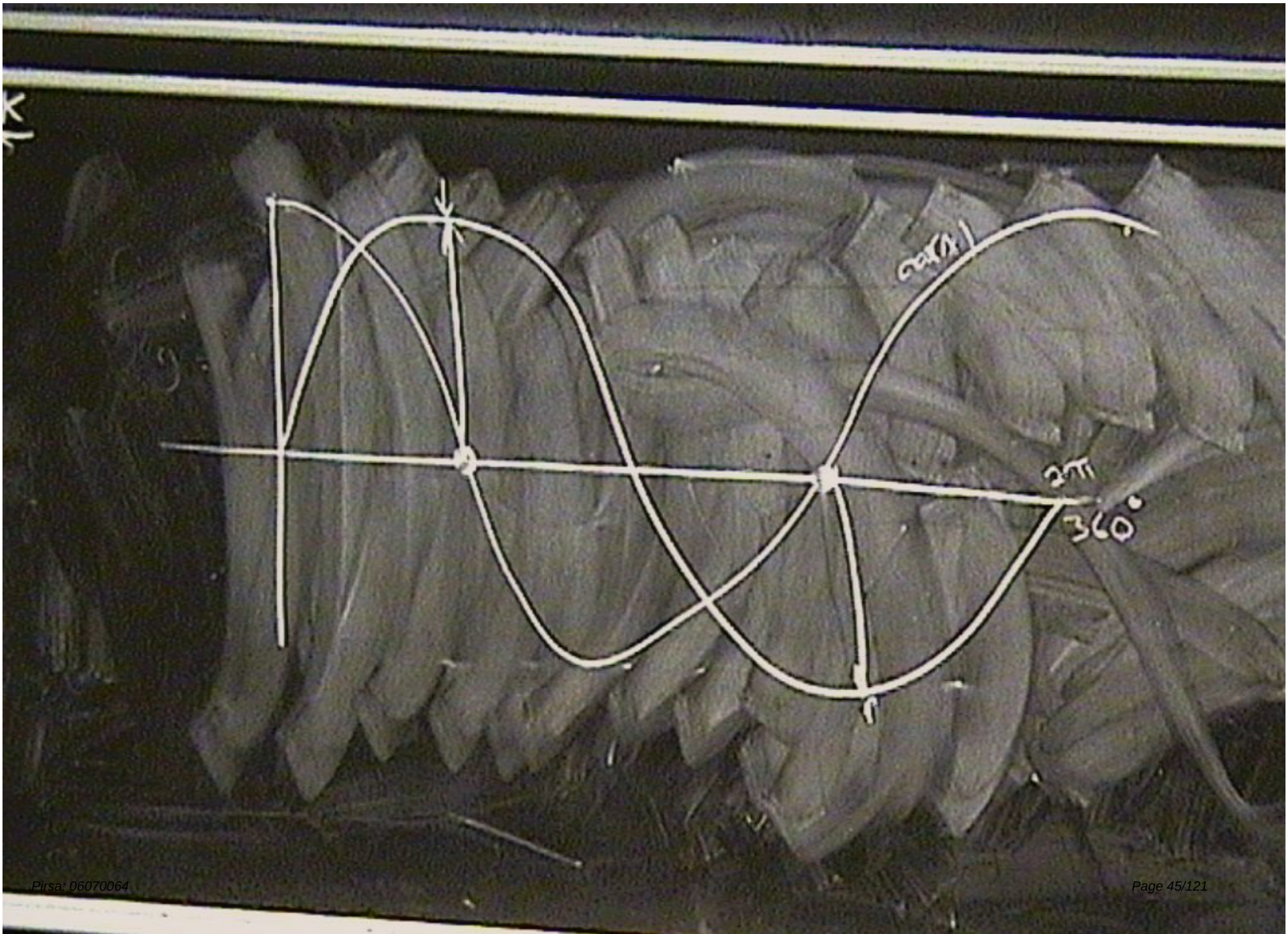
$$f(x) = \sin(x)$$

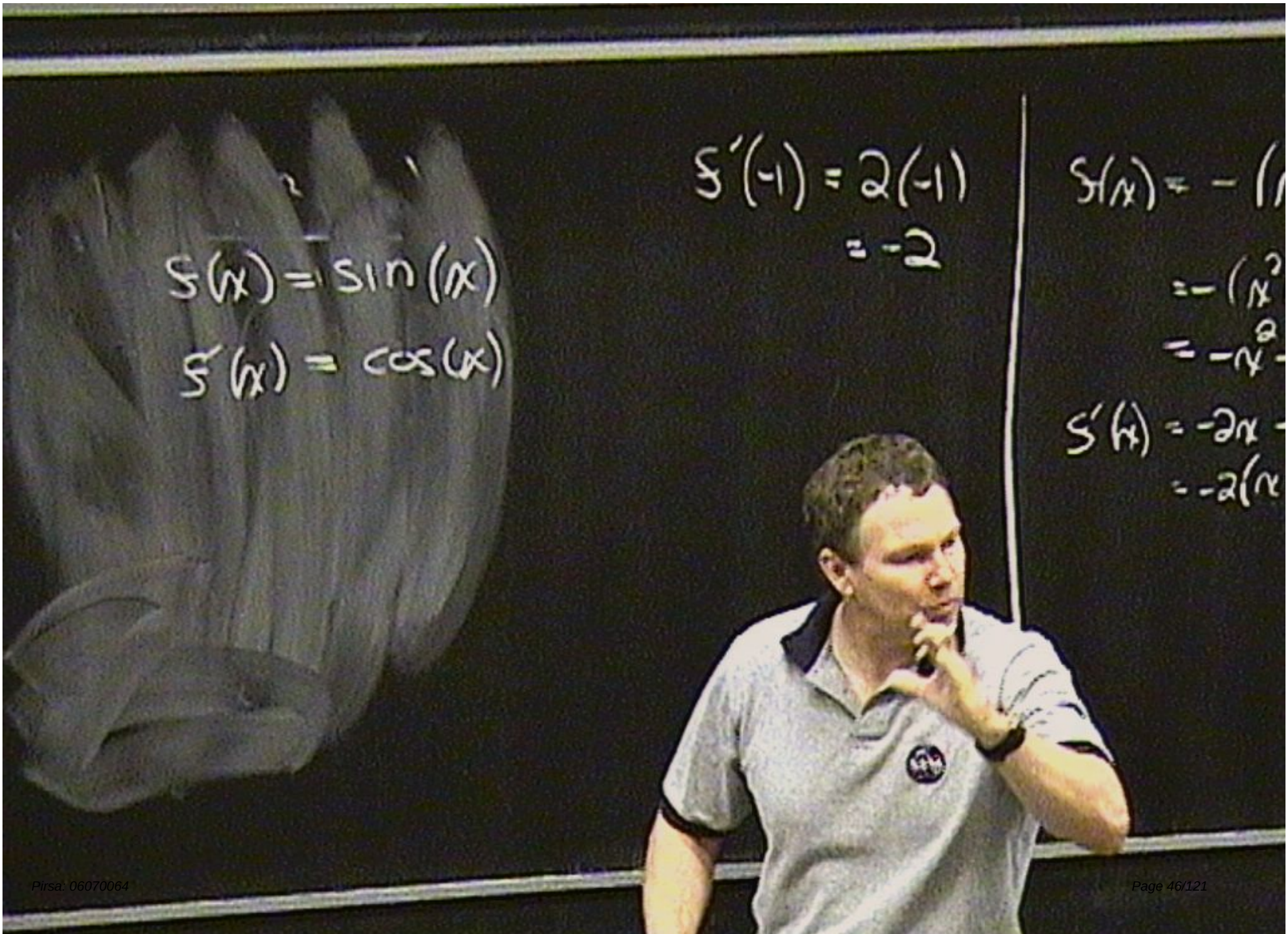
$$f'(x) = \cos(x)$$

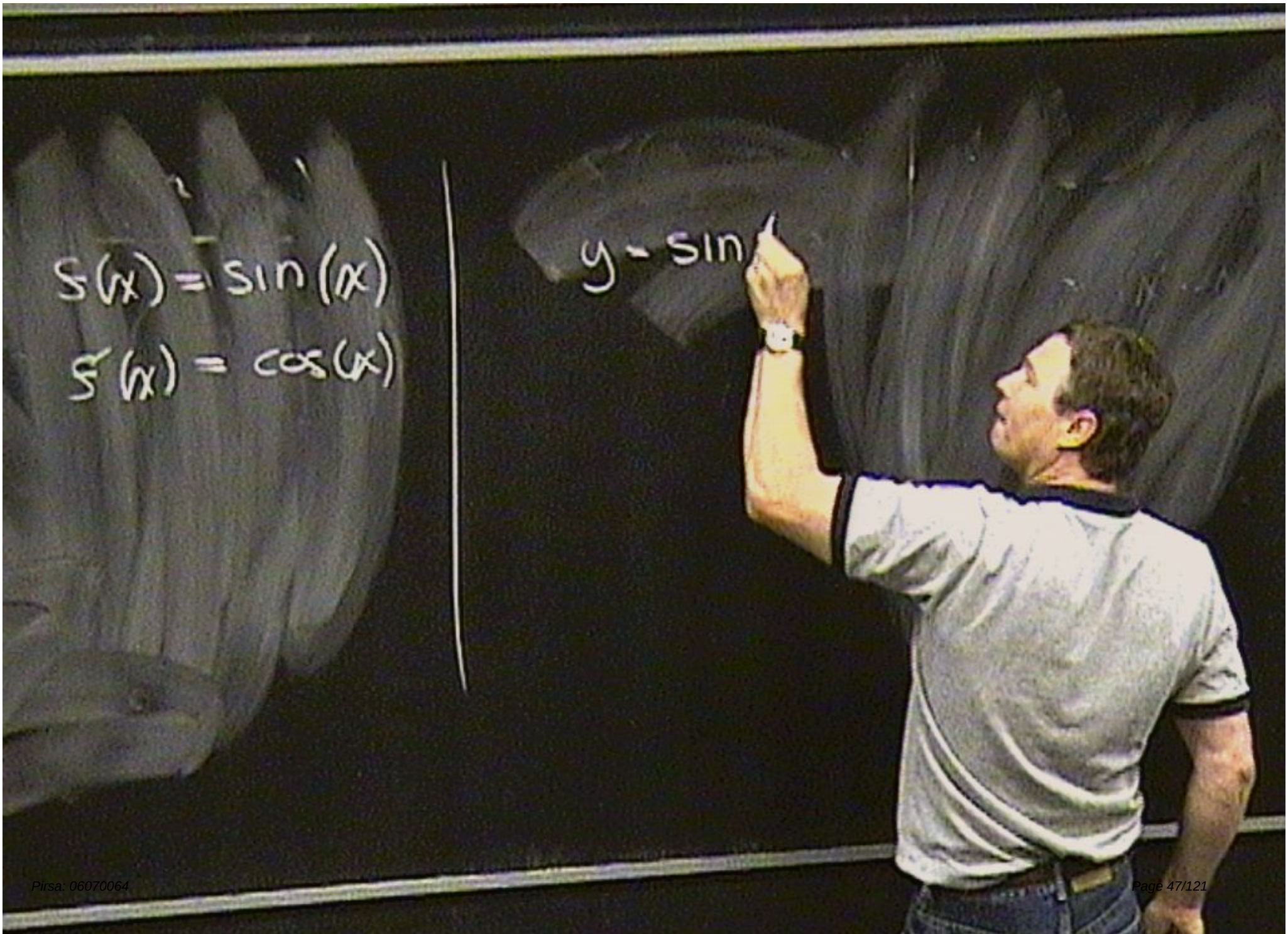
$$f'(-1) = 2(-1)$$

$$= -2$$


2π
360°


cos(x)
2π
360°

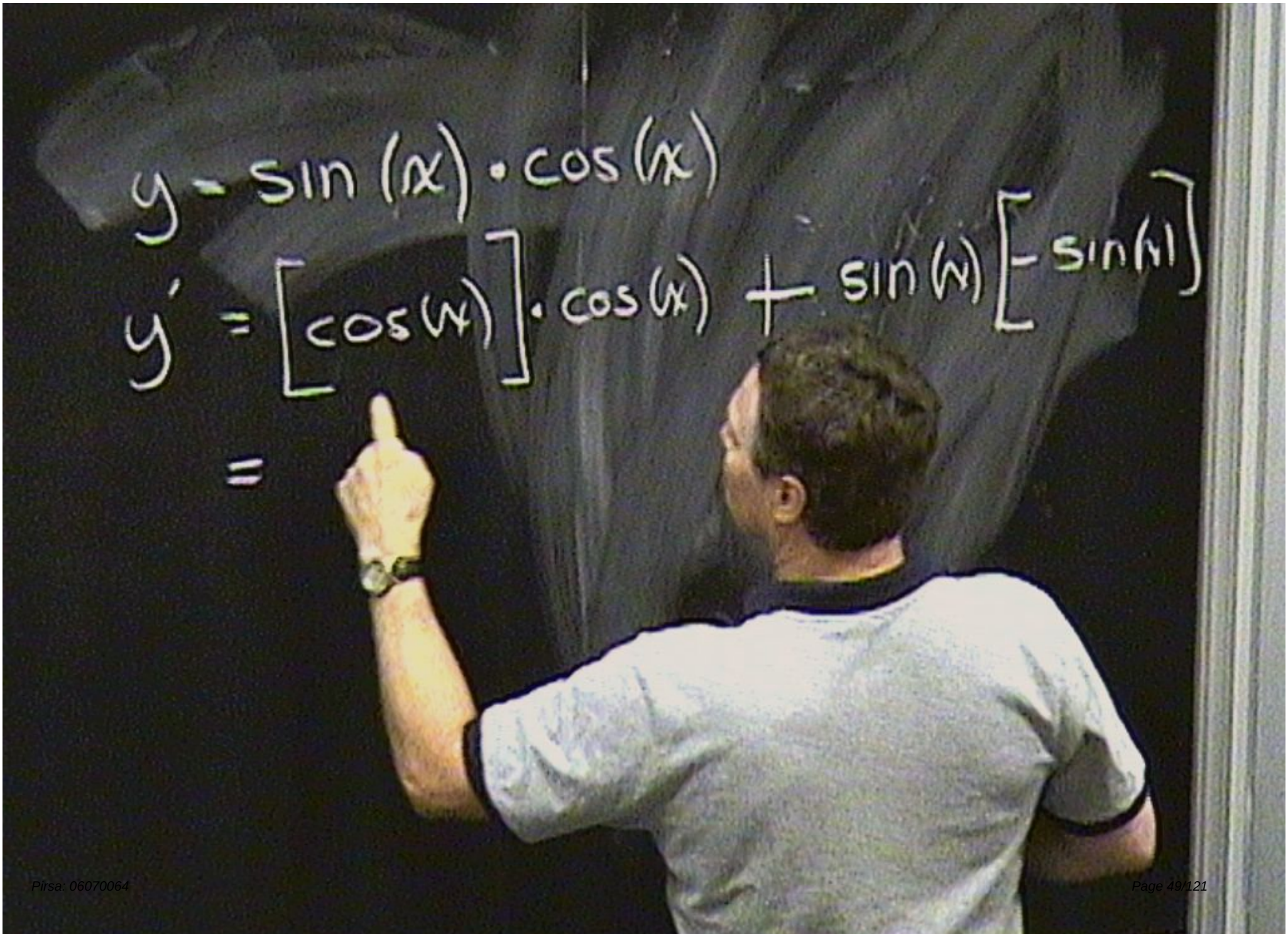

f(x) = sin(x)
f'(x) = cos(x)
f'(-1) = 2(-1)
= -2

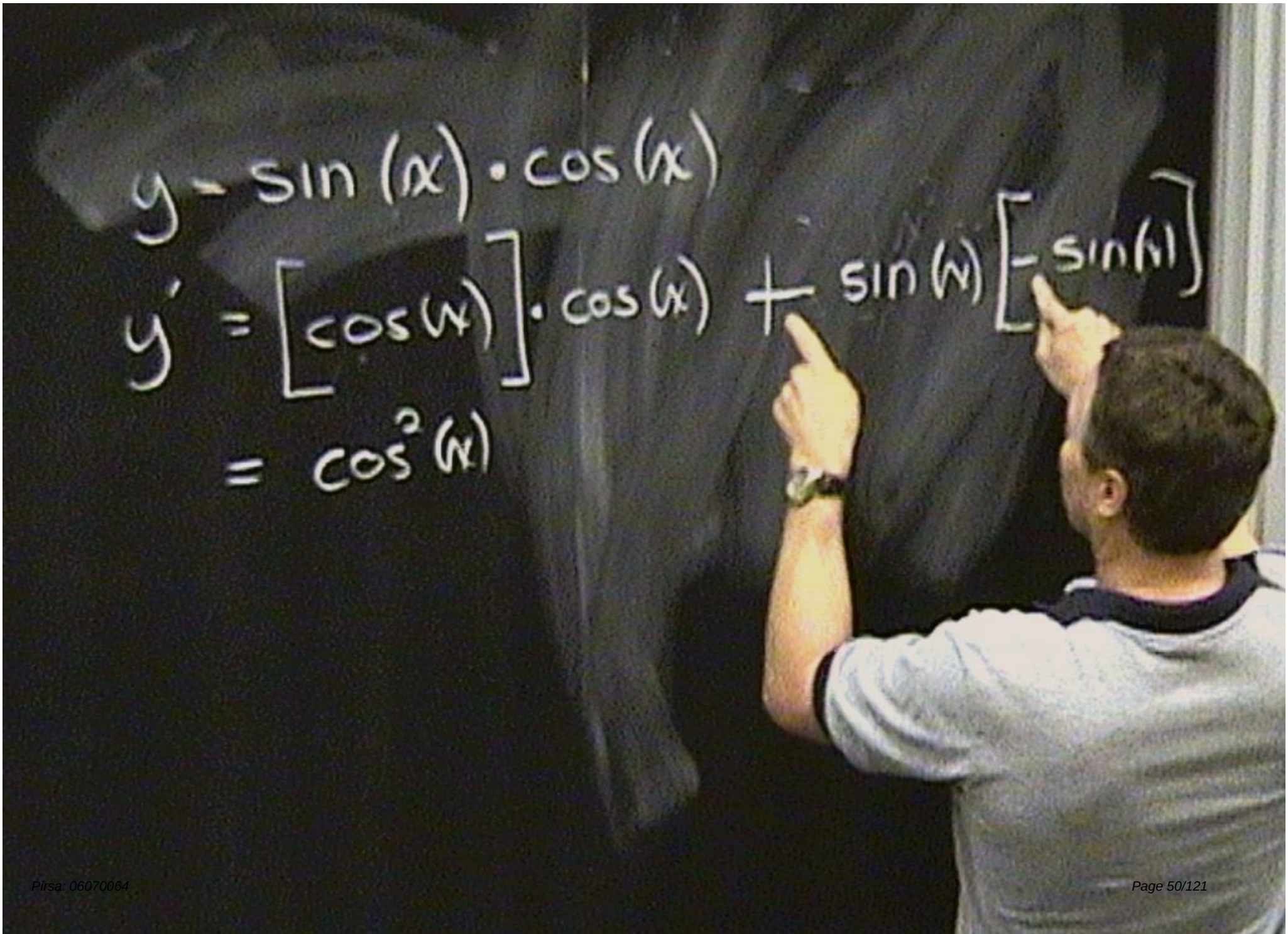

S(x) = sin(x)
S'(x) = cos(x)
y = sin

n(x)

os(x)

$$y = \sin(x) \cdot \cos(x)$$


y = sin(x) · cos(x)
y' = [cos(x)] · cos(x) + sin(x) [-sin(x)]
=


y = sin(x) • cos(x)
y' = [cos(x)] • cos(x) + sin(x) [-sin(x)]
= cos²(x)

$$y = \sin(x) \cdot \cos(x)$$

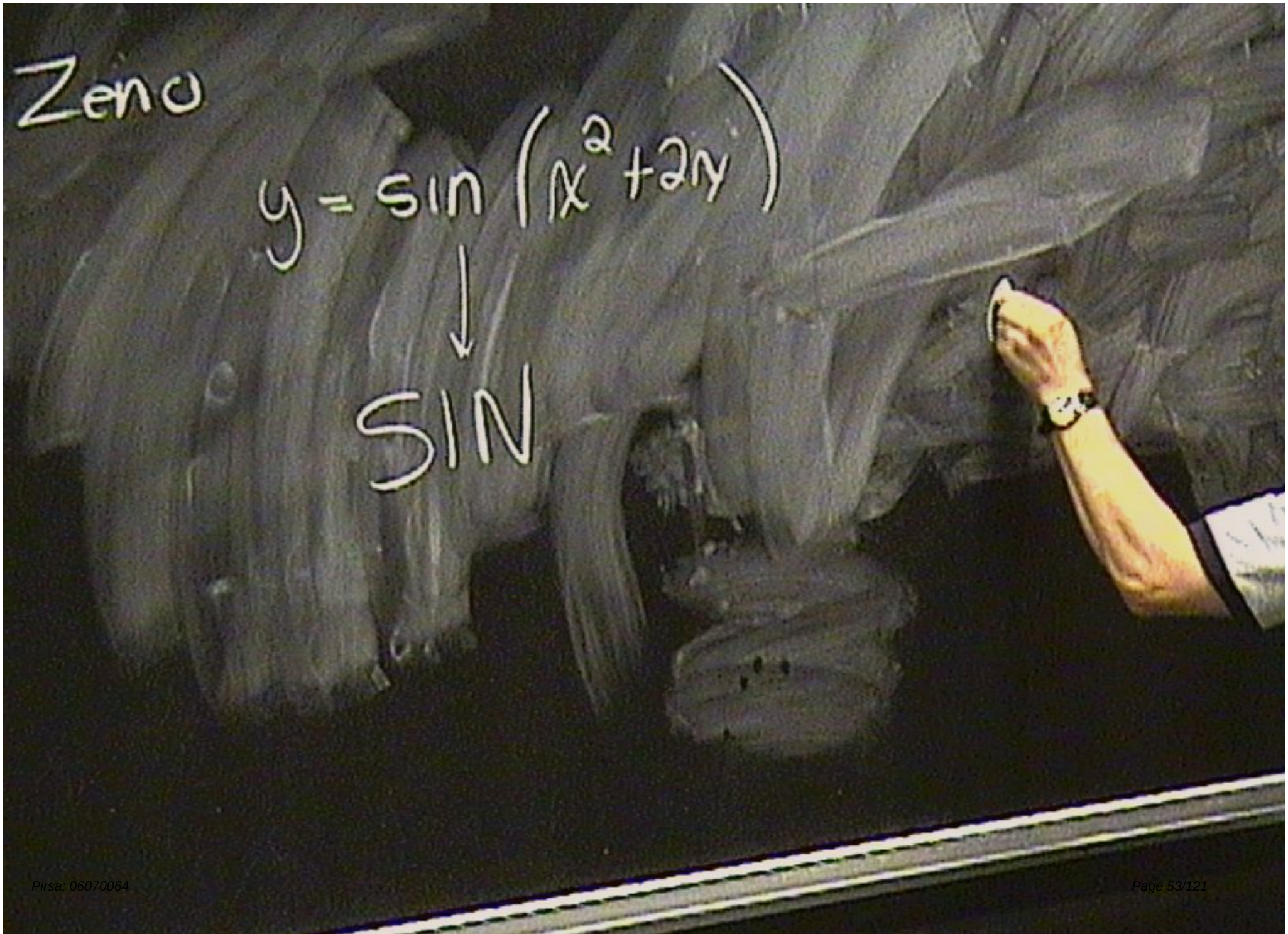
$$y' = [\cos(x)] \cdot \cos(x) + \sin(x)[-\sin(x)]$$

$$= \cos^2(x) - \sin^2(x)$$

$$[\cos(x)]^2 - [\sin(x)]^2$$

Zeno

$$y = \sin\left(x^2 + 2x\right)$$


Zeno
y = sin (x^2 + 2y)
SIN

$$y = \sin(x^2 + 2x)$$

$$\downarrow$$

SIN

$$x^2 + 2x$$

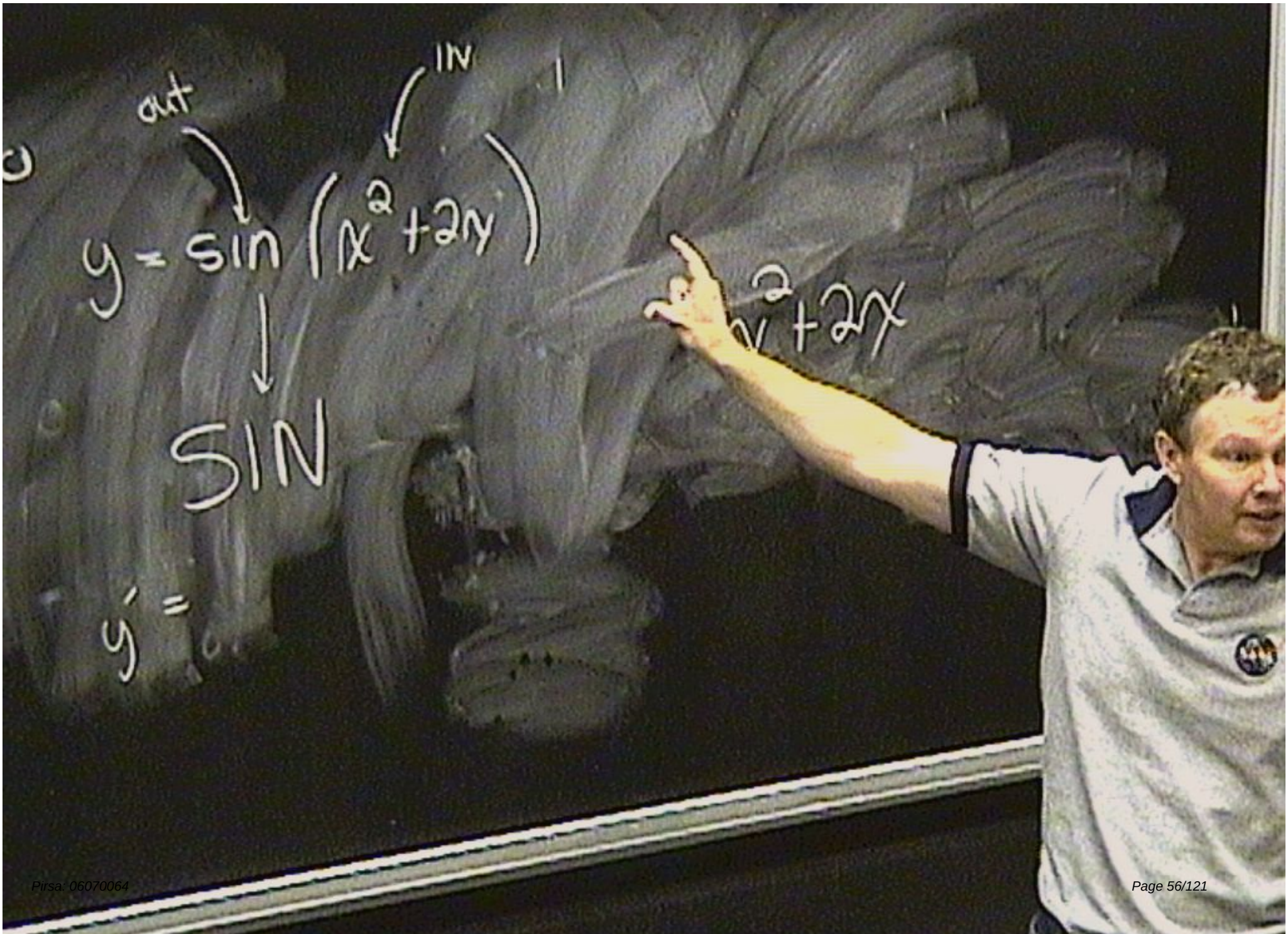
out

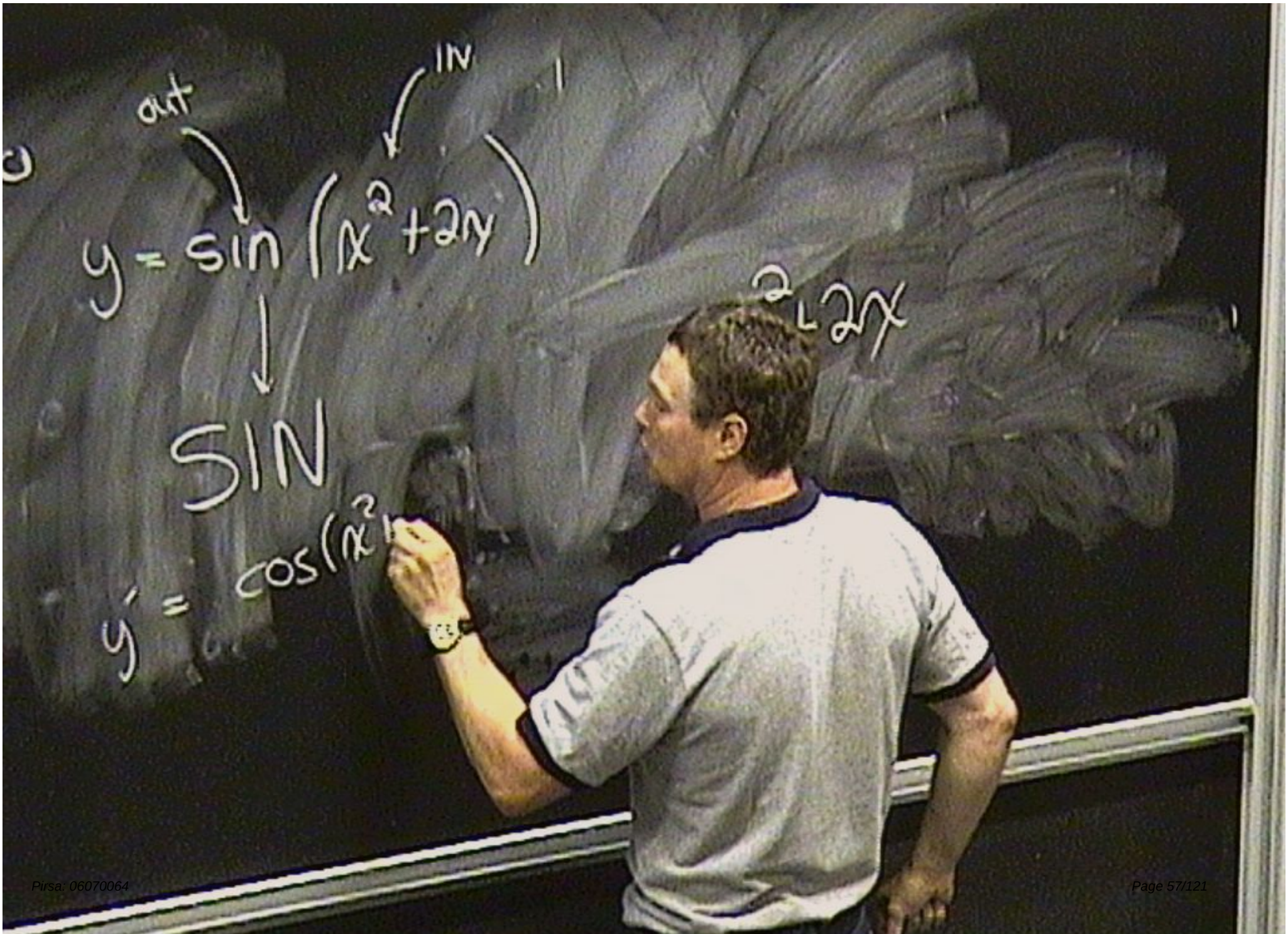
IN

$$y = \sin(x^2 + 2x)$$

SIN

$x^2 + 2x$


out
IN
y = sin (x^2 + 2x)
SIN
y' =


out
IN
y = sin (x^2 + 2x)
SIN
y' = cos(x^2
2x

Zeno

out

IN

$$y = \sin(x^2 + 2x)$$

SIN

$$y' = \cos(x^2+2x) \cdot (2x+2)$$

x^2+2x

Zeno

out

IN

$$y = \sin(x^2 + 2x)$$

SIN

$$x^2 + 2x$$

$$y' = \cos(x^2 + 2x) \cdot (2x + 2)$$

Zeno

out

in

$$y = \sin(x^2 + 2x)$$

SIN

$$x^2 + 2x$$

$$y' = \cos(x^2 + 2x) \cdot (2x + 2)$$

Zeno

out

in

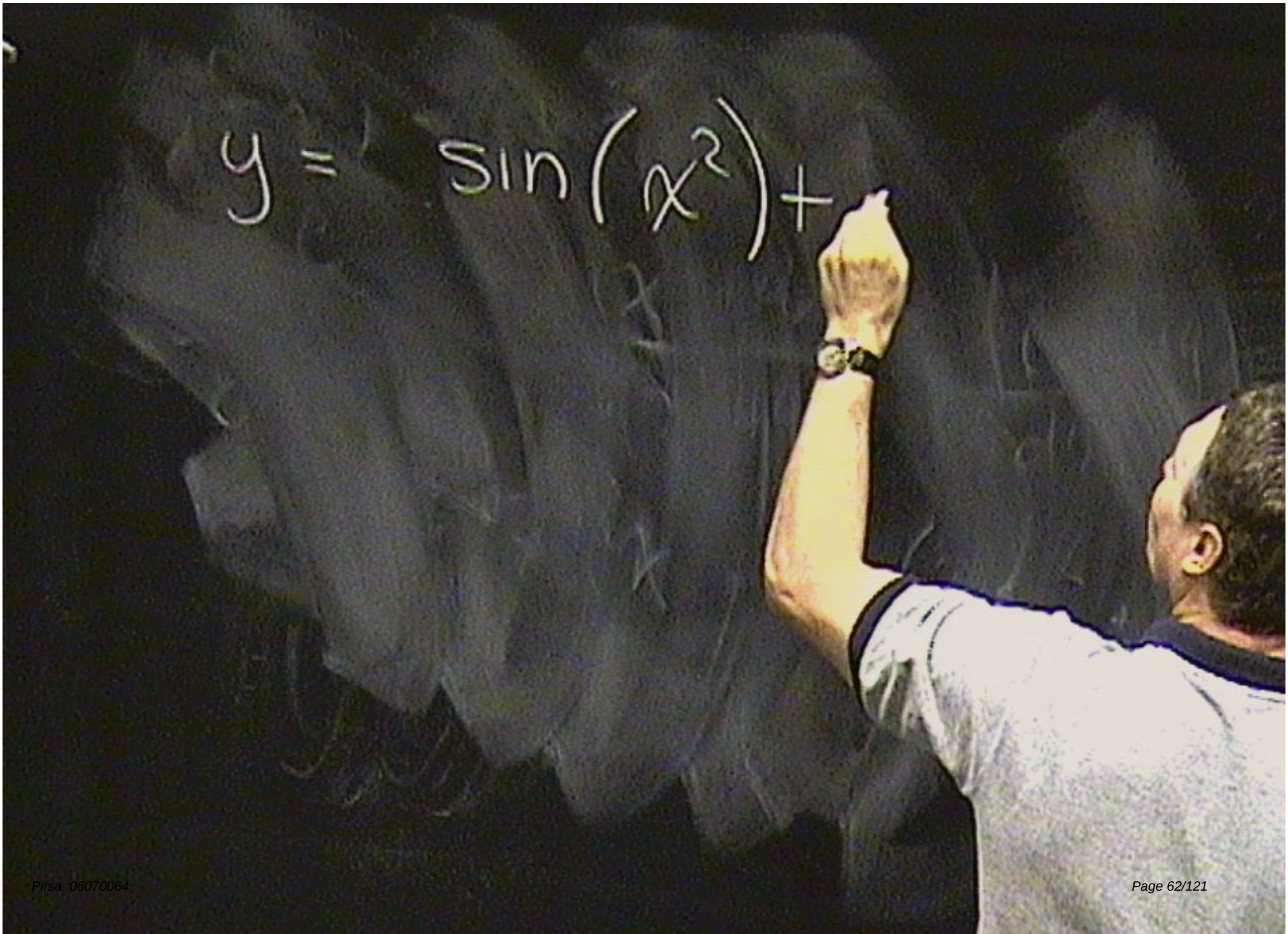
$$y = \sin(x^2 + 2x)$$

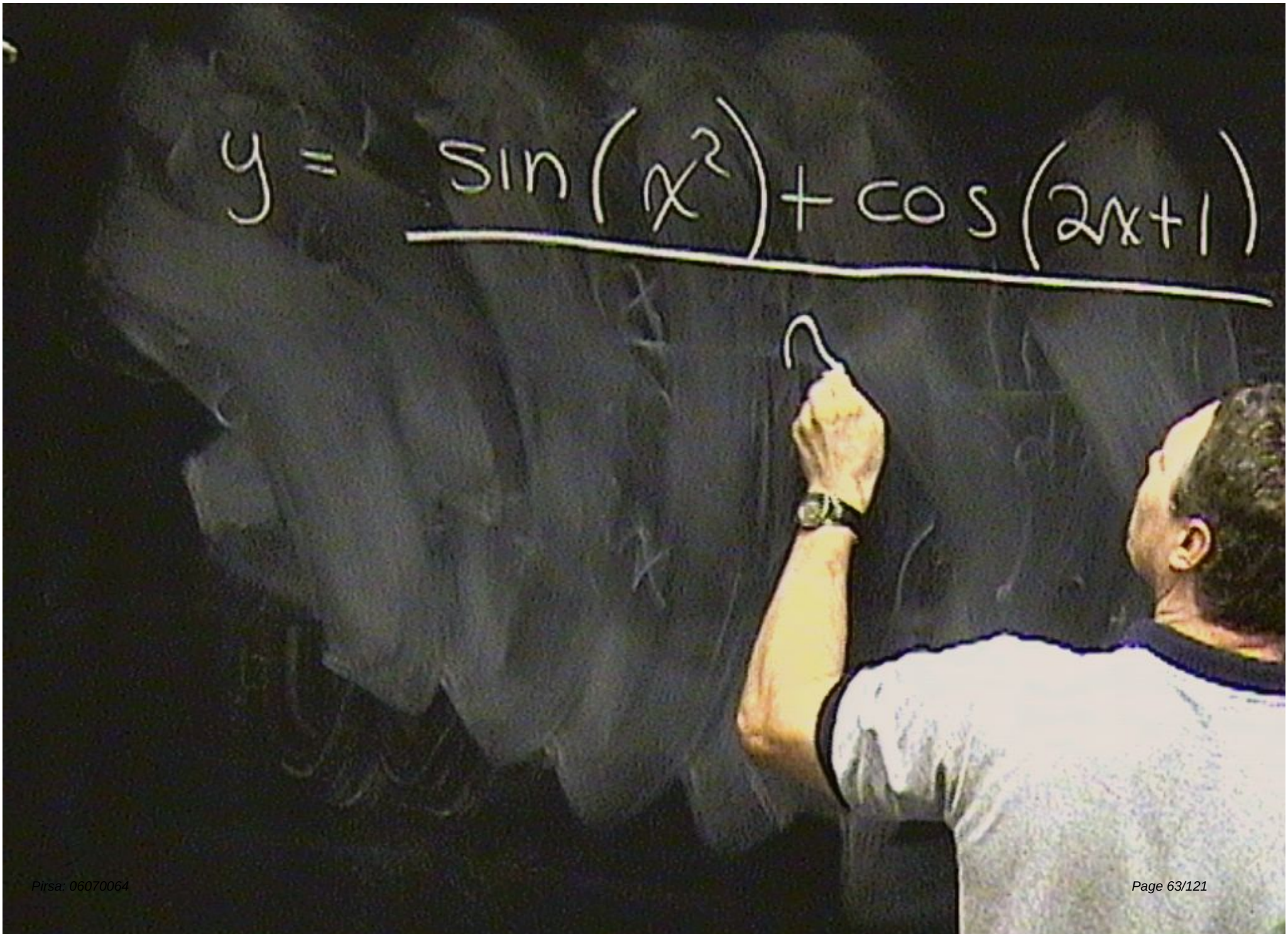
SIN

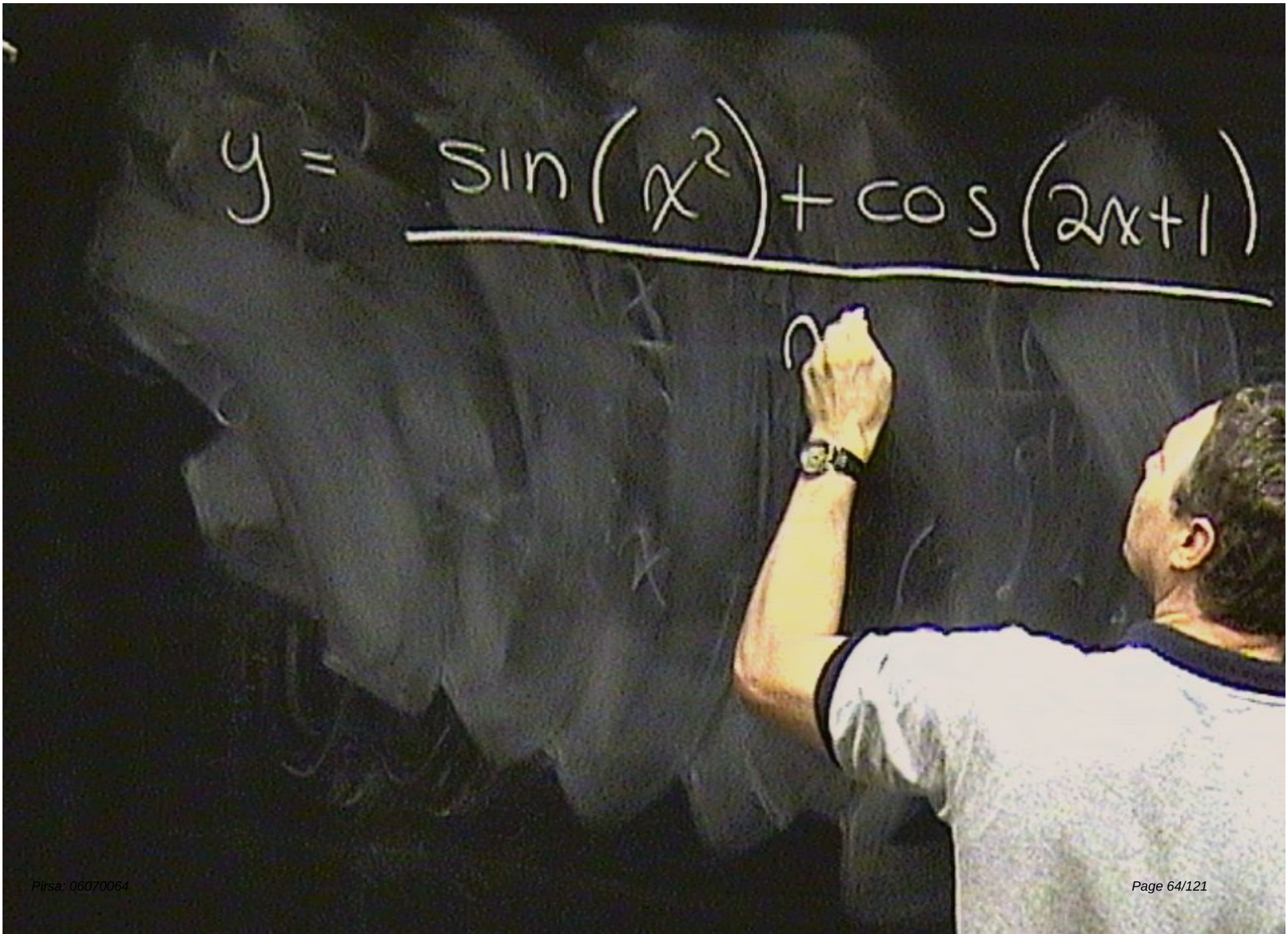
$$y' = \cos(x^2+2x) \cdot (2x+2)$$

$$\frac{dy}{dw} \cdot \frac{dw}{dx}$$

$$x^2 + 2x$$


y = sin(x²)+

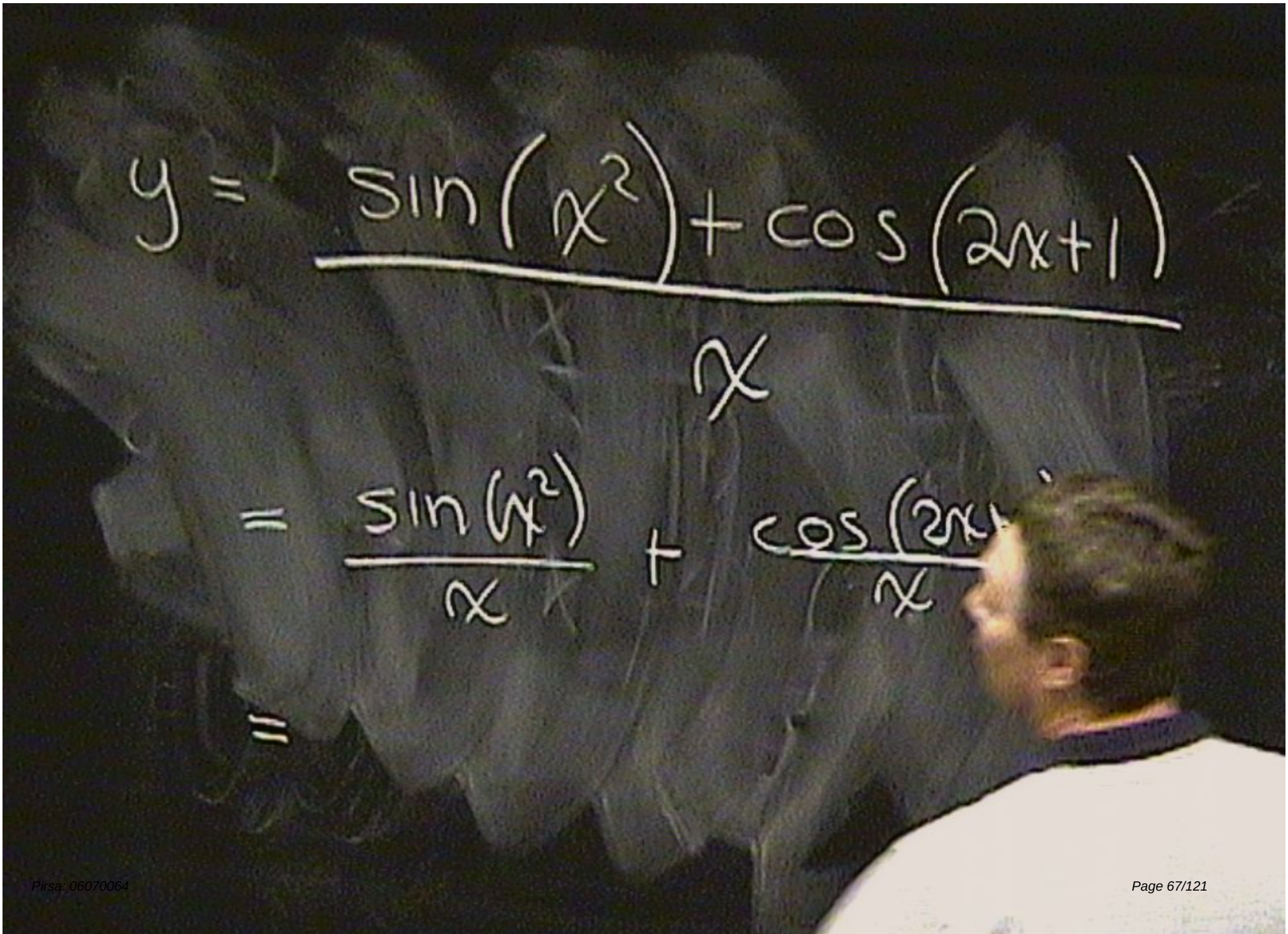

y = sin(x²) + cos(2πx+1)


y = sin(x²) + cos(2πx+1)

$$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$$

$$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$$

$$= \frac{\sin(x^2)}{x} + \frac{\cos(2x+1)}{x}$$


$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$
$= \frac{\sin(x^2)}{x} + \frac{\cos(2x}{x}$
$=$

$$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$$

$$= \frac{\sin(x^2)}{x} + \frac{\cos(2x+1)}{x}$$

$$=$$

$$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$$

$$= \frac{\sin(x^2)}{x} + \frac{\cos(2x+1)}{x}$$

$$= \sin(x^2)\cdot x^{-1} + \cos(2x+1)\cdot x^{-1}$$

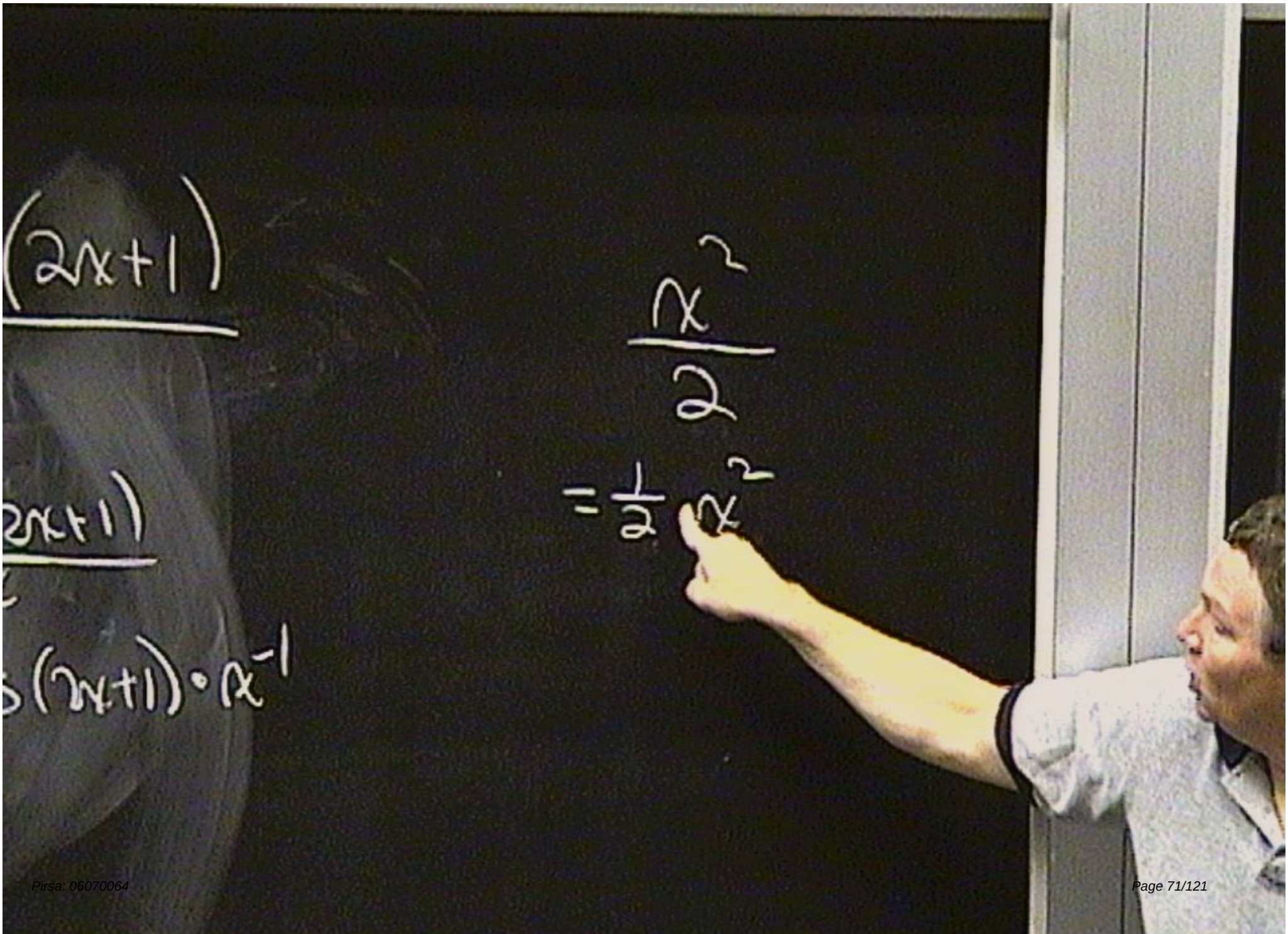
$(2x+1)$

$2x+1)$

$(2x+1)\cdot x^{-1}$

$$\frac{x^2}{2}$$

$$= \frac{1}{2} x^2$$


(2x+1)
2x+1)
s(2x+1)·x^-1
x^2/2
=1/2 x^2

$$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$$

$$= \frac{\sin(x^2)}{x} + \frac{\cos(2x+1)}{x}$$

$$= \sin(x^2)\cdot x^{-1} + \cos(2x+1)\cdot x^{-1}$$

$$y = \frac{\sin(x^2) + \cos(2x+1)}{x}$$

$$= \frac{\sin(x^2)}{x} + \frac{\cos(2x+1)}{x}$$

$$= \sin(x^2)\cdot x^{-1} + \cos(2x+1)\cdot x^{-1}$$

$$\underbrace{\sin(x^2)}\cdot\underbrace{x^{-1}}$$

$$= [\quad](\quad) + (\quad)[\quad]$$

$$\underbrace{\cos(2x+1)}\cdot\underbrace{x^{-1}}$$

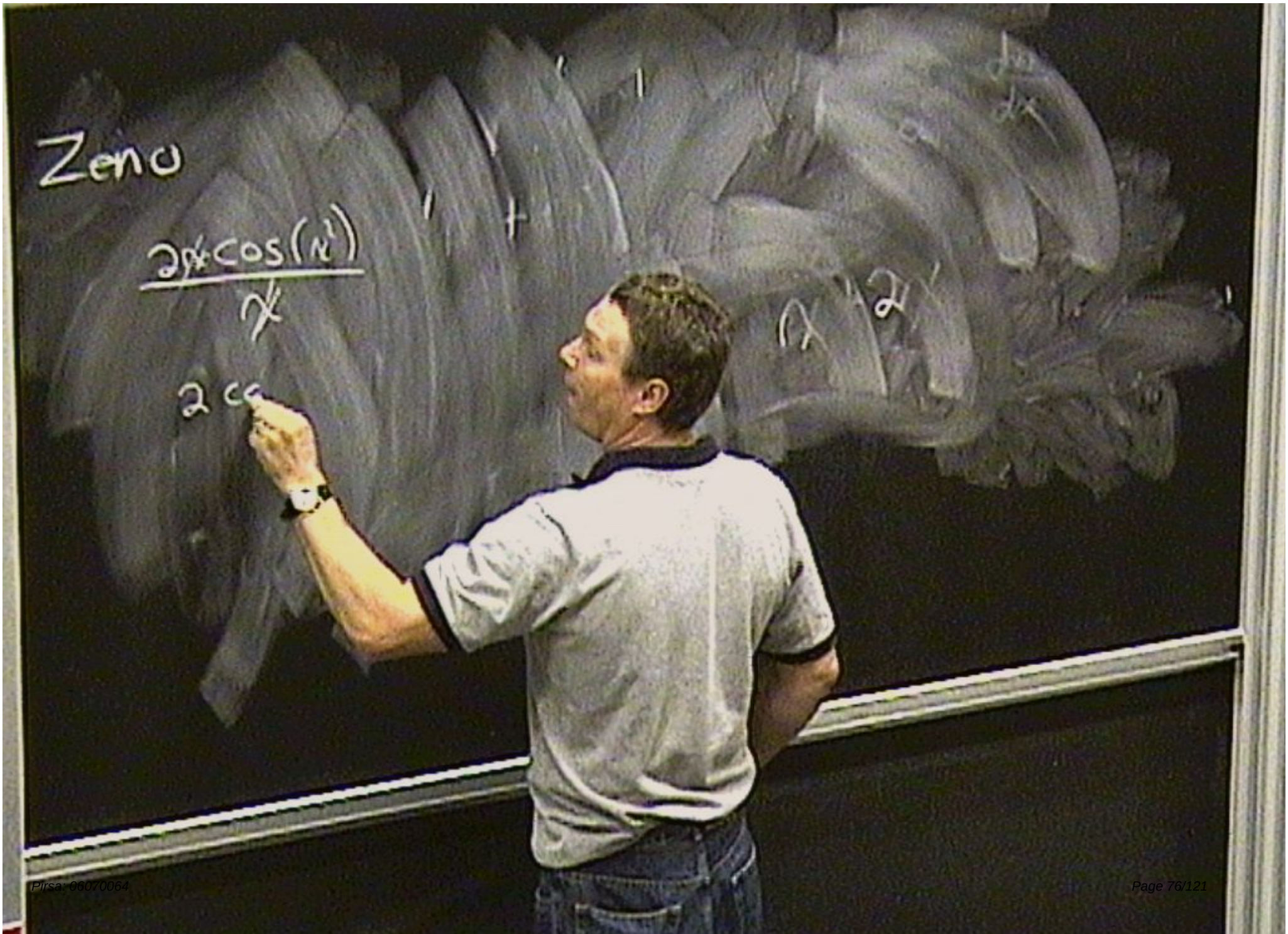
$$= [\quad](\quad) + (\quad)[\quad]$$

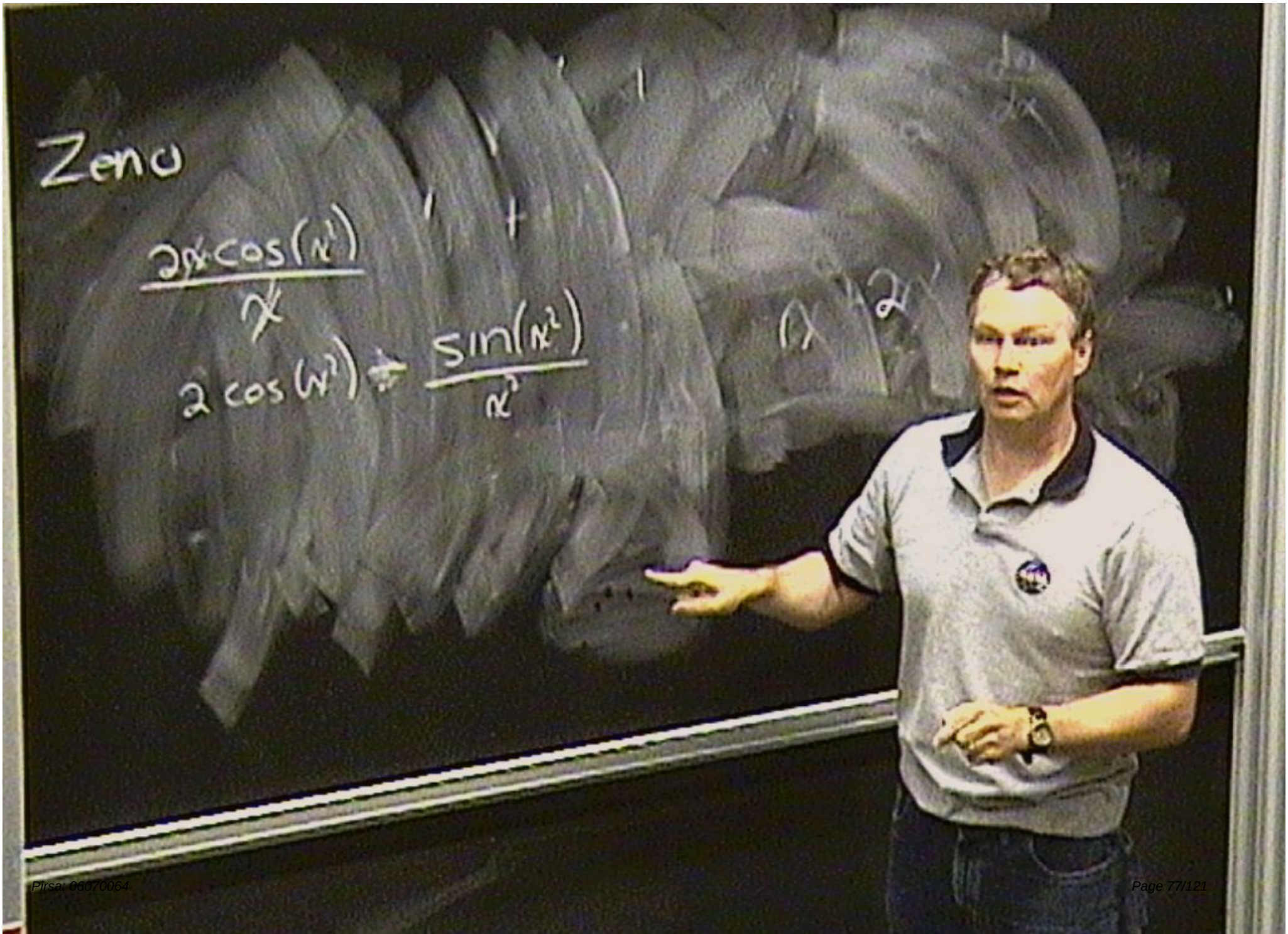
$$\underbrace{\sin(x^2)}\cdot\underbrace{x^{-1}}$$

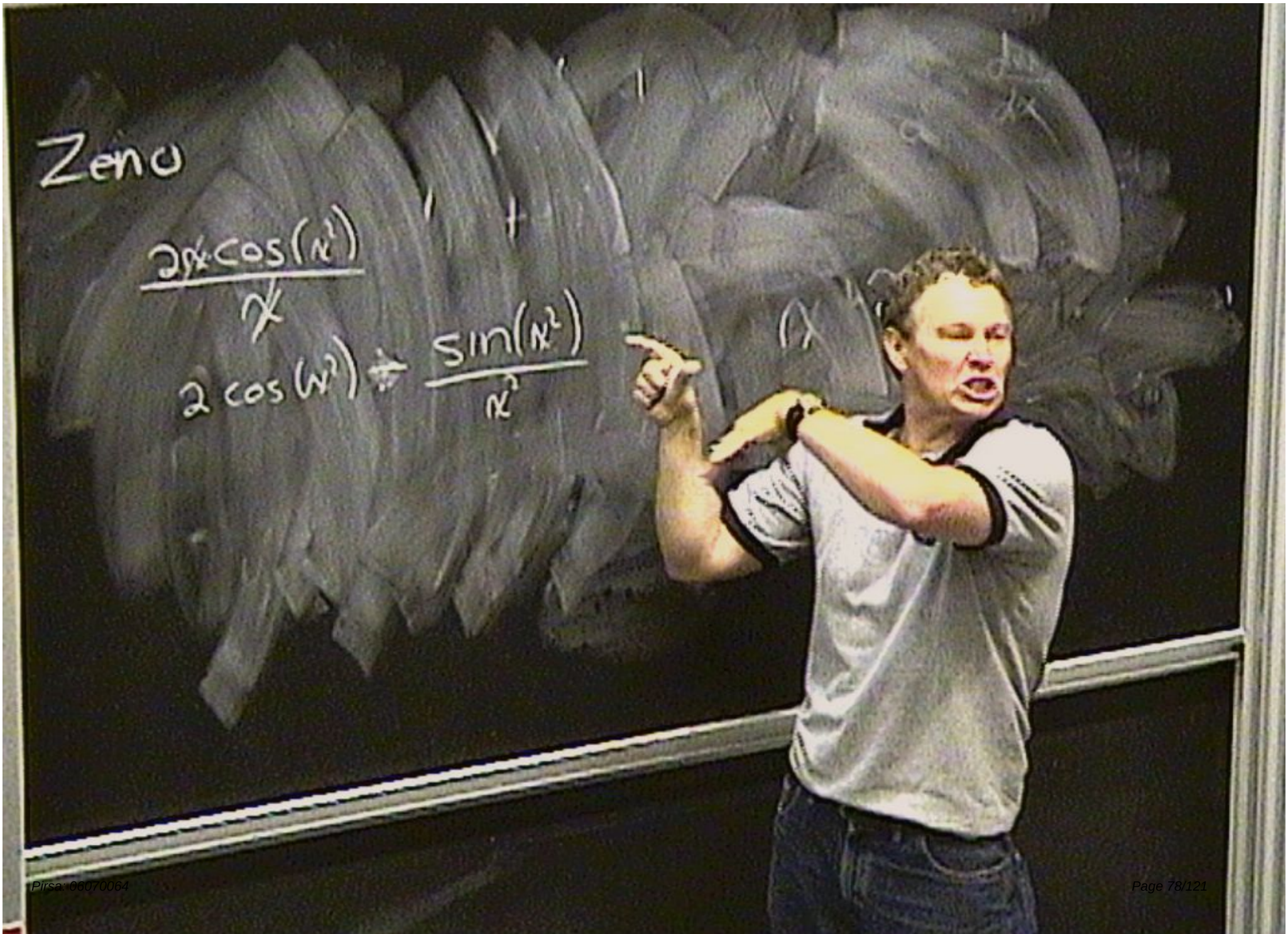
$$= \left[\cos(x^2)\cdot 2x\right]\left(x^{-1}\right) + \left(\sin(x^2)\right)\left[-x^{-2}\right]$$

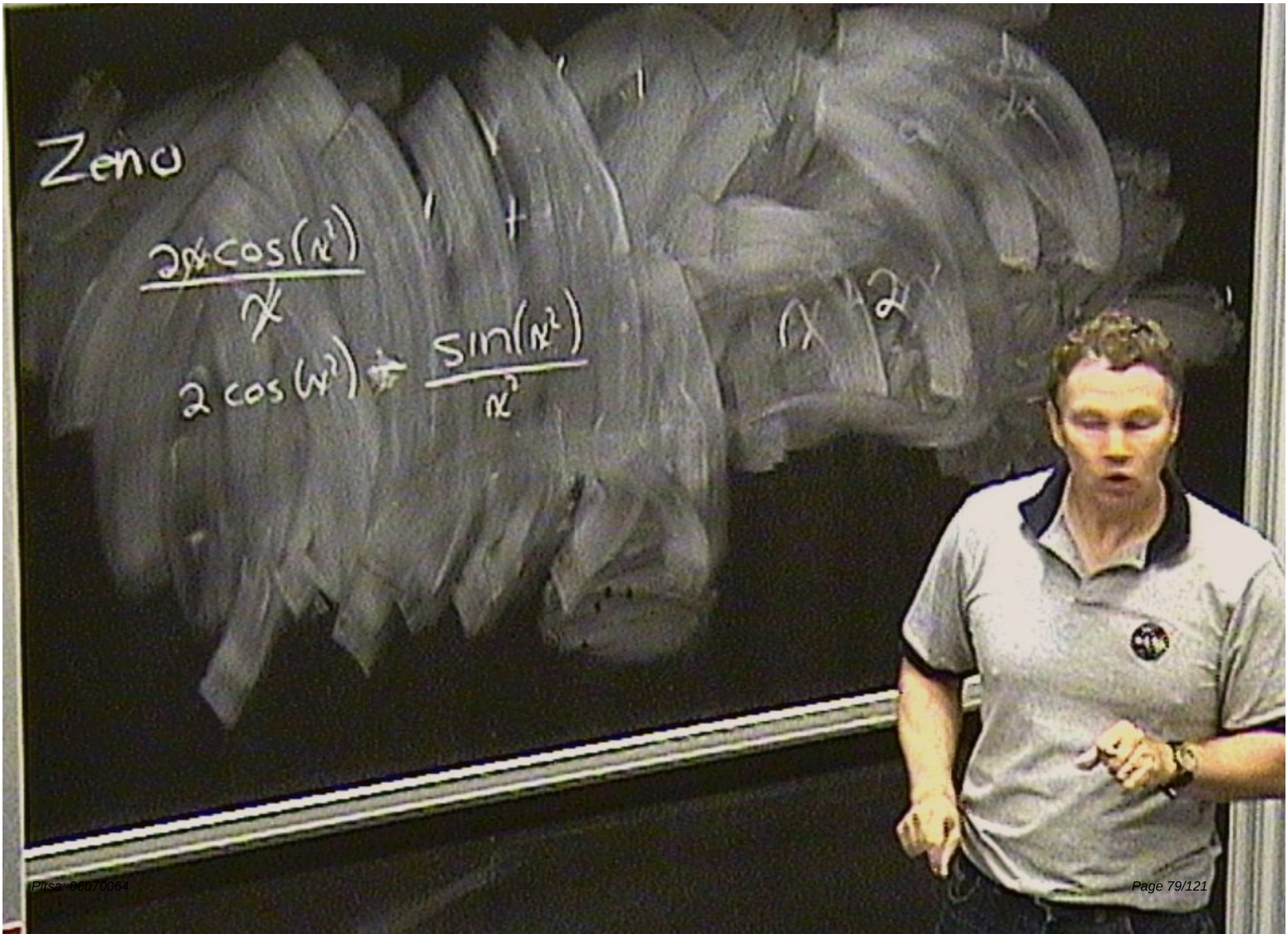
$$\underbrace{\cos(2x+1)}\cdot\underbrace{x^{-1}}$$

$$= \left[-\sin(2x+1)\cdot\quad\right]\left(\quad\right) + \left(\quad\right)\left[\quad\right]$$


Zeno


Zeno
$\frac{2x\cos(x^2)}{x}$
$2\cos(x^2) - \frac{\sin(x^2)}{x^2}$


Zeno
$\frac{2x\cos(x^2)}{x}$
$2\cos(x^2) - \frac{\sin(x^2)}{x^2}$


Zeno
$\frac{2x\cos(x^2)}{x}$
$2\cos(x^2) + \frac{\sin(x^2)}{x^2}$

Zeno

$$\frac{2\cancel{x}\cos(x^2)}{\cancel{x}}$$

$$2\cos(x^2) + \frac{\sin(x^2)}{x^2} - \frac{2\sin(2x+1)}{x^2} + \frac{\cos(2x+1)}{x^2}$$

$$10^2 = 100$$

$$10^2 = 100$$

$$\log_{10}(100) =$$

$$10^2 = 100$$

$$\log_{10}(100) = 10^{\boxed{2}}$$

$$10^2 = 100$$

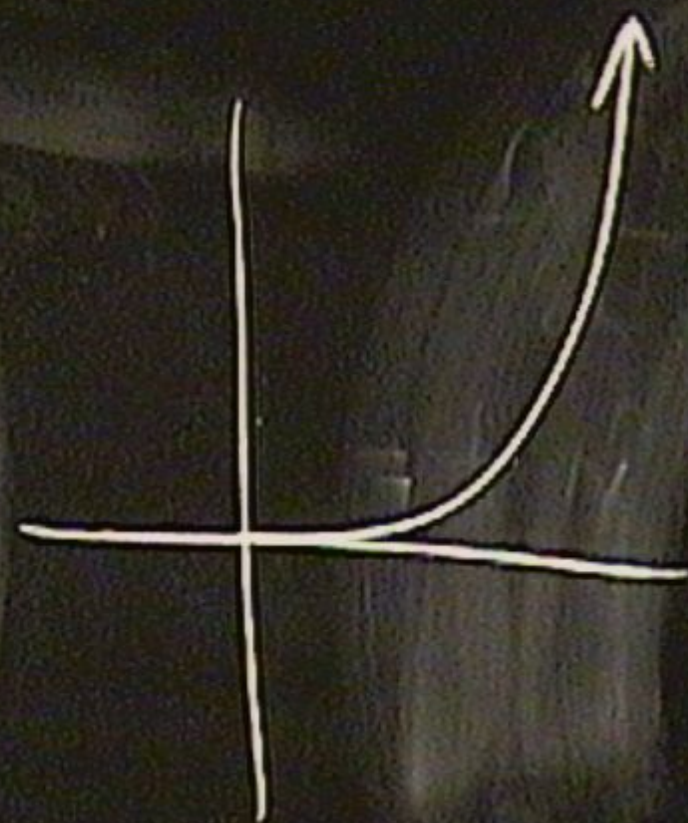
$$\log_{10}(100) = 10^{\boxed{a}}$$

$$\log_{10}(93) =$$

$$10^2 = 100$$

$$\log_{10}(100) = 10^{\boxed{2}}$$

$$\log_{10}(93) =$$



$$y = e^x$$

$$y' = e^x$$

$$\log_e(x) = \ln(x)$$

$$y = e^x$$

$$y' = e^x$$

$$\log_e(x) = \ln(x)$$

e

$y = e^x$

$y' = e^x$

$\log_e(x) = \ln(x)$

$e = 2.71\ldots$

$y = e^x$

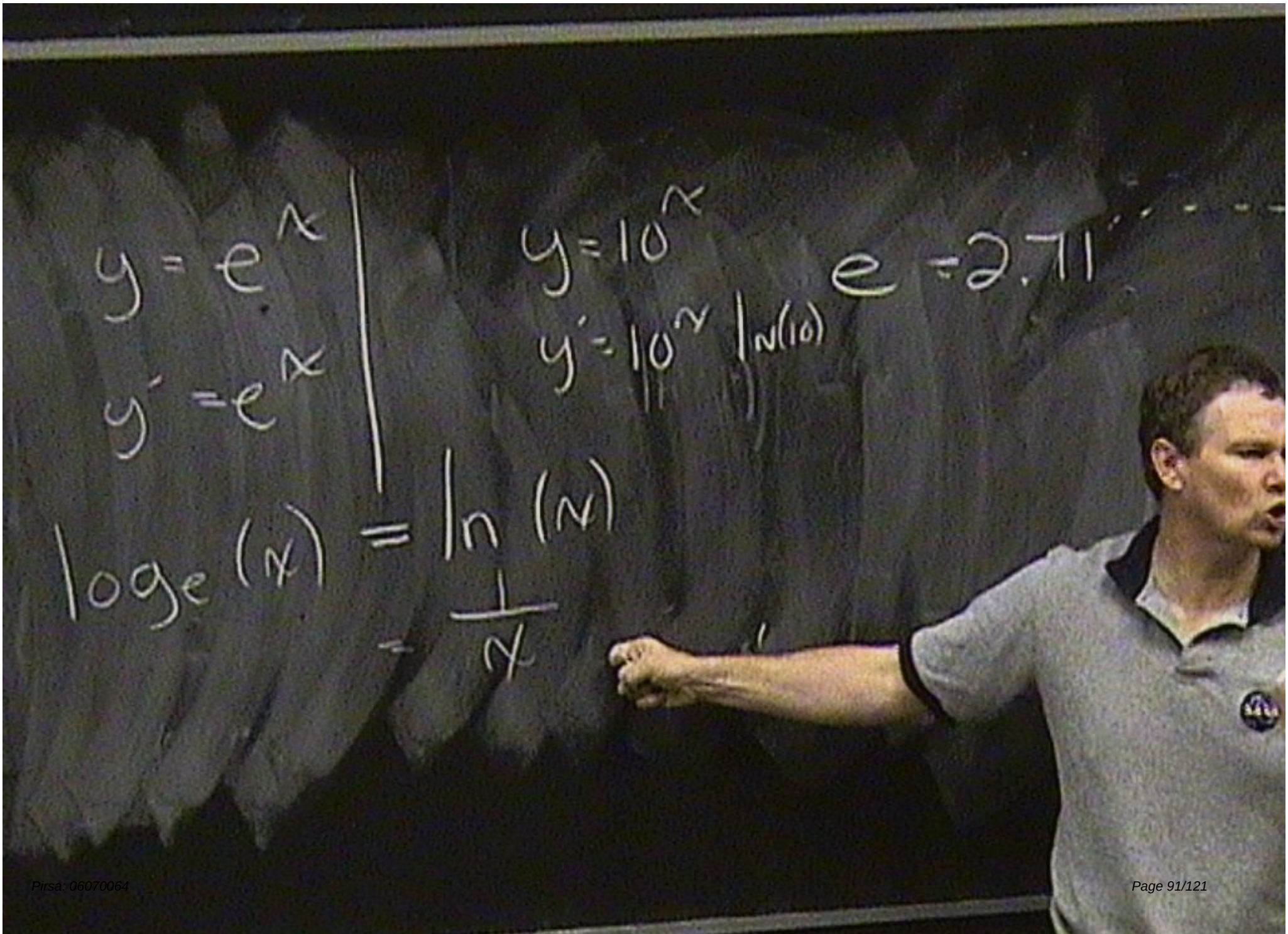
$y' = e^x$

$y = 10^x$

$y' = 10^x \ln(10)$

$e = 2.71\ldots$

$\log_e(x) = \ln(x)$


y = e^x
y' = e^x
y = 10^x
y' = 10^x ln(10)
e = 2.71
log_e(x) = ln(x)
= 1/x

$y = e^x$

$y' = e^x$

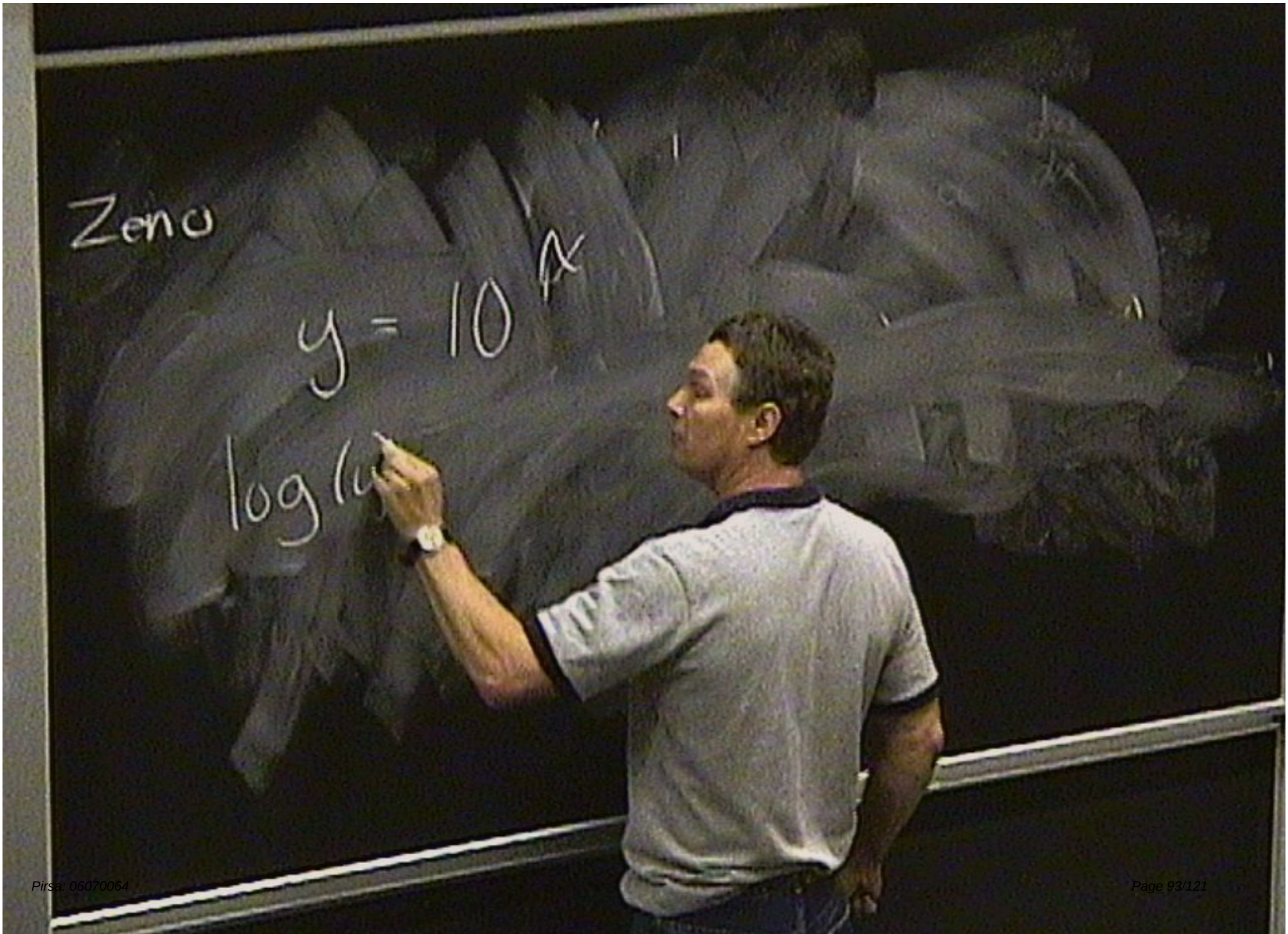
$y = 10^x$

$y' = 10^x \ln(10)$

$e = 2.71\ldots$

$\log_e(x) = \ln(x)$

$= \frac{1}{x}$


Zeno
y = 10^x
log(

Zeno

$$y = 10^x$$

$$\log_e(y) = \log_e(10^x)$$

$$\ln(y) = \ln(10^x)$$

$$\ln(y) = x\ln(10)$$

Zeno

$$y = 10^x$$

$$\log_e(y) = \log_e(10^x)$$

$$\ln(y) = \ln(10^x)$$

$$\ln(y) = x\ln(10)$$

$$\frac{1}{y} \cdot y'$$

Zeno

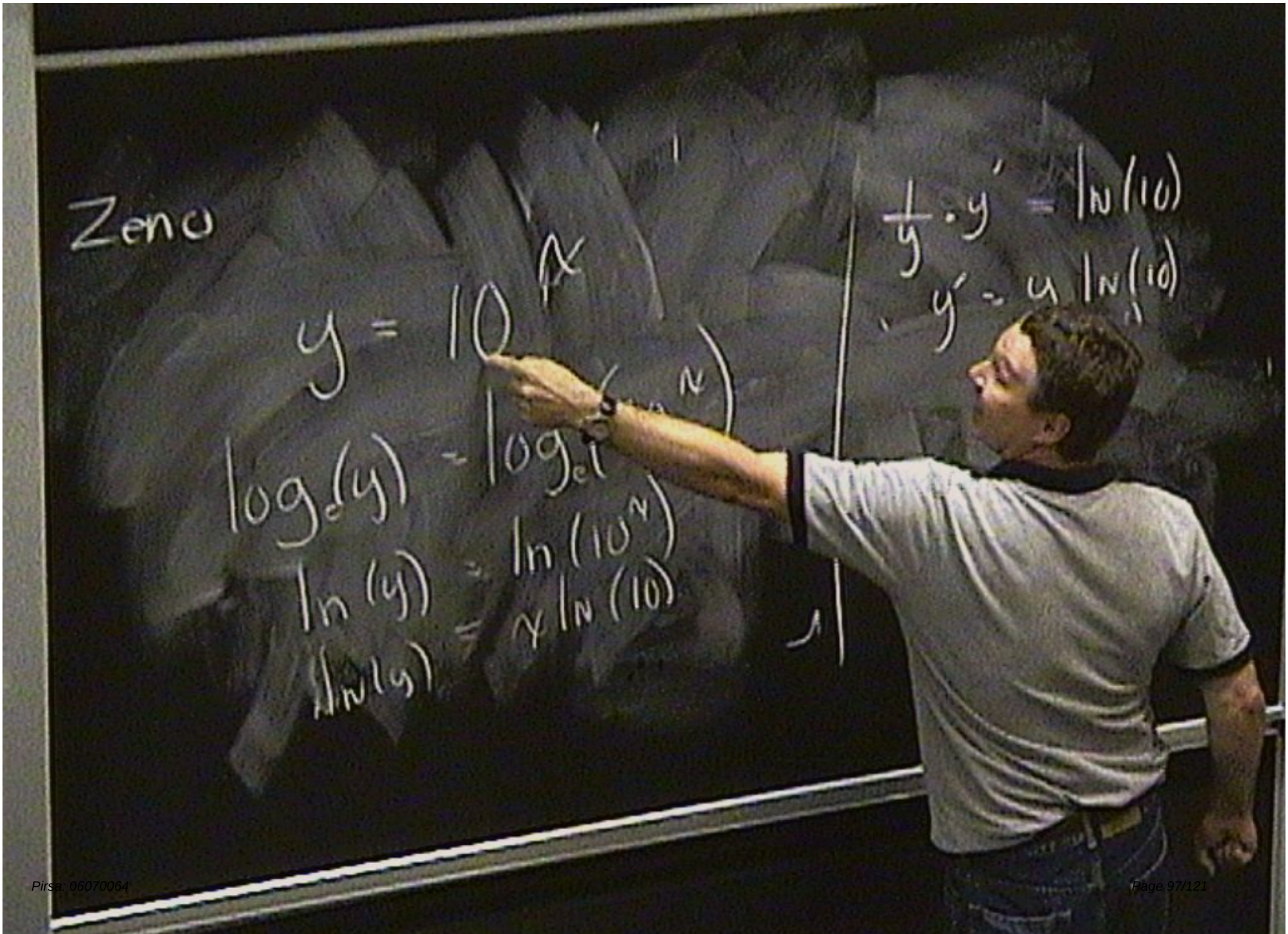
$$y = 10^x$$

$$\log_e(y) = \log_e(10^x)$$

$$\ln(y) = \ln(10^x)$$

$$\ln(y) = x\ln(10)$$

$$\frac{1}{y}\cdot y' =$$


Zeno
y = 10^x
log_e(y) = log_e
ln(y) = ln(10^x)
ln(y) = x ln(10)
1/y · y' = ln(10)
y' = y ln(10)

Zeno

$$y = 10^x$$

$$\log_e(y) = \log_e(10^x)$$

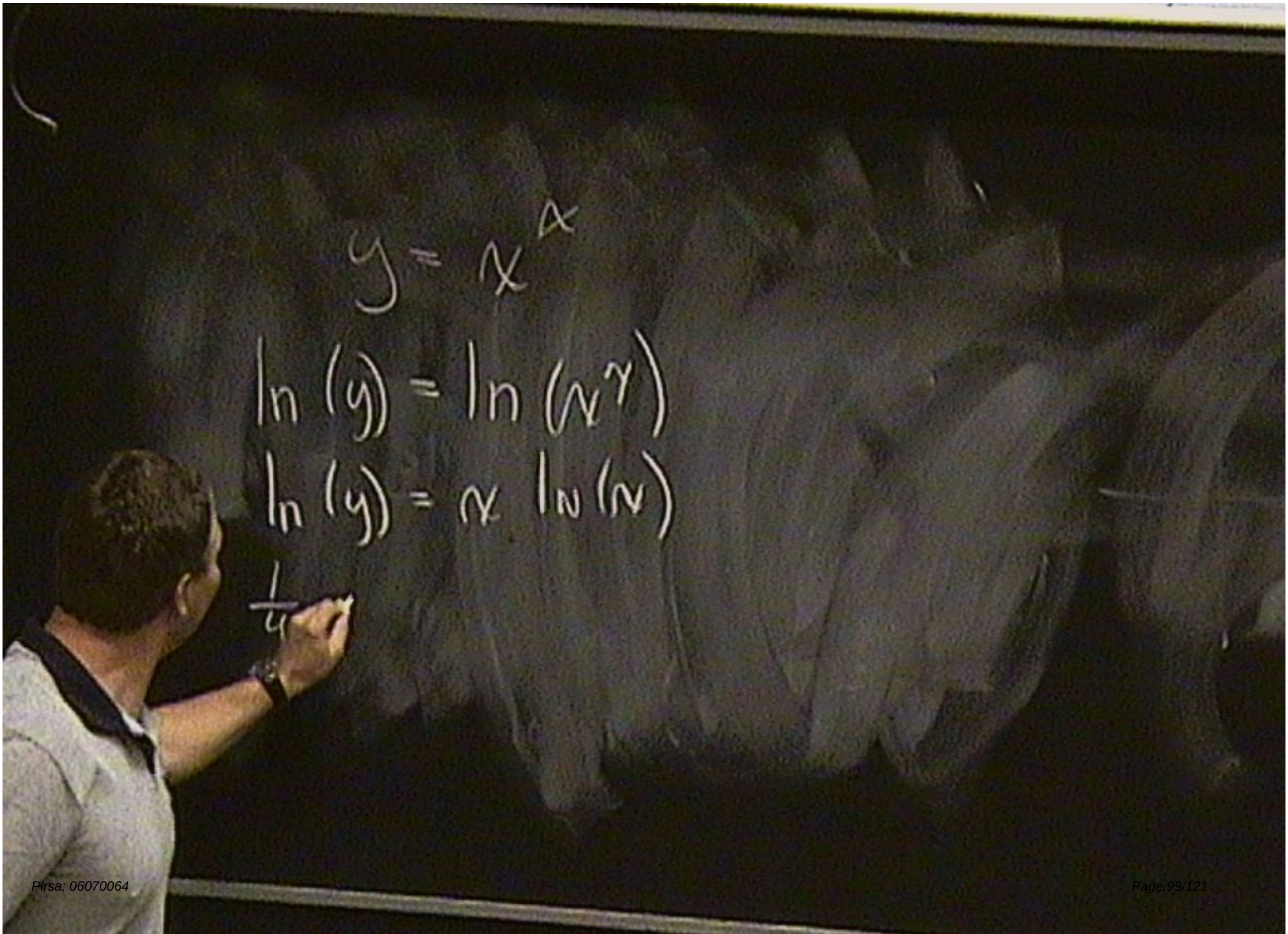
$$\ln(y) = \ln(10^x)$$

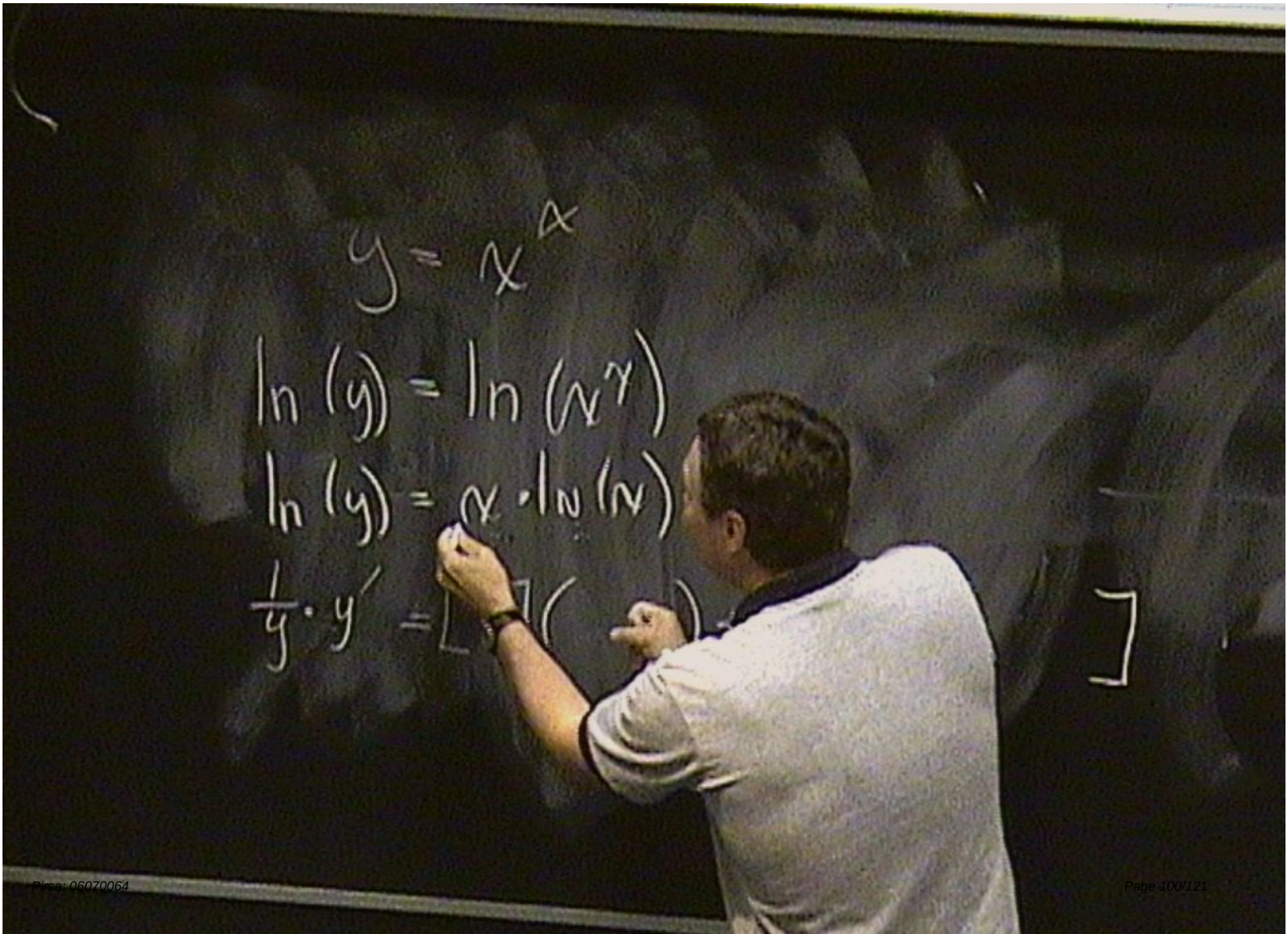
$$\ln(y) = x\ln(10)$$

$$\frac{1}{y}\cdot y' = \ln(10)$$

$$y' = y\ln(10)$$

$$= 10^x \ln(10)$$


$y = x^{\alpha}$
$\ln(y) = \ln(x^{\alpha})$
$\ln(y) = \alpha \ln(x)$
$\frac{1}{y}$


$y = x^{\alpha}$
$\ln(y) = \ln(x^{\alpha})$
$\ln(y) = \alpha \cdot \ln(x)$
$\frac{1}{y} \cdot y' =$

$$y = x^{\alpha}$$

$$\ln(y) = \ln(x^{\alpha})$$

$$1 = \underbrace{\alpha}\,\underbrace{\ln(x)}$$

$$= [1](\ln(x)) + (\alpha)\left[\frac{1}{x}\right]$$

$$= \ln(x) + 1$$

$$y = x^x$$

$$\ln(y) = \ln(x^x)$$

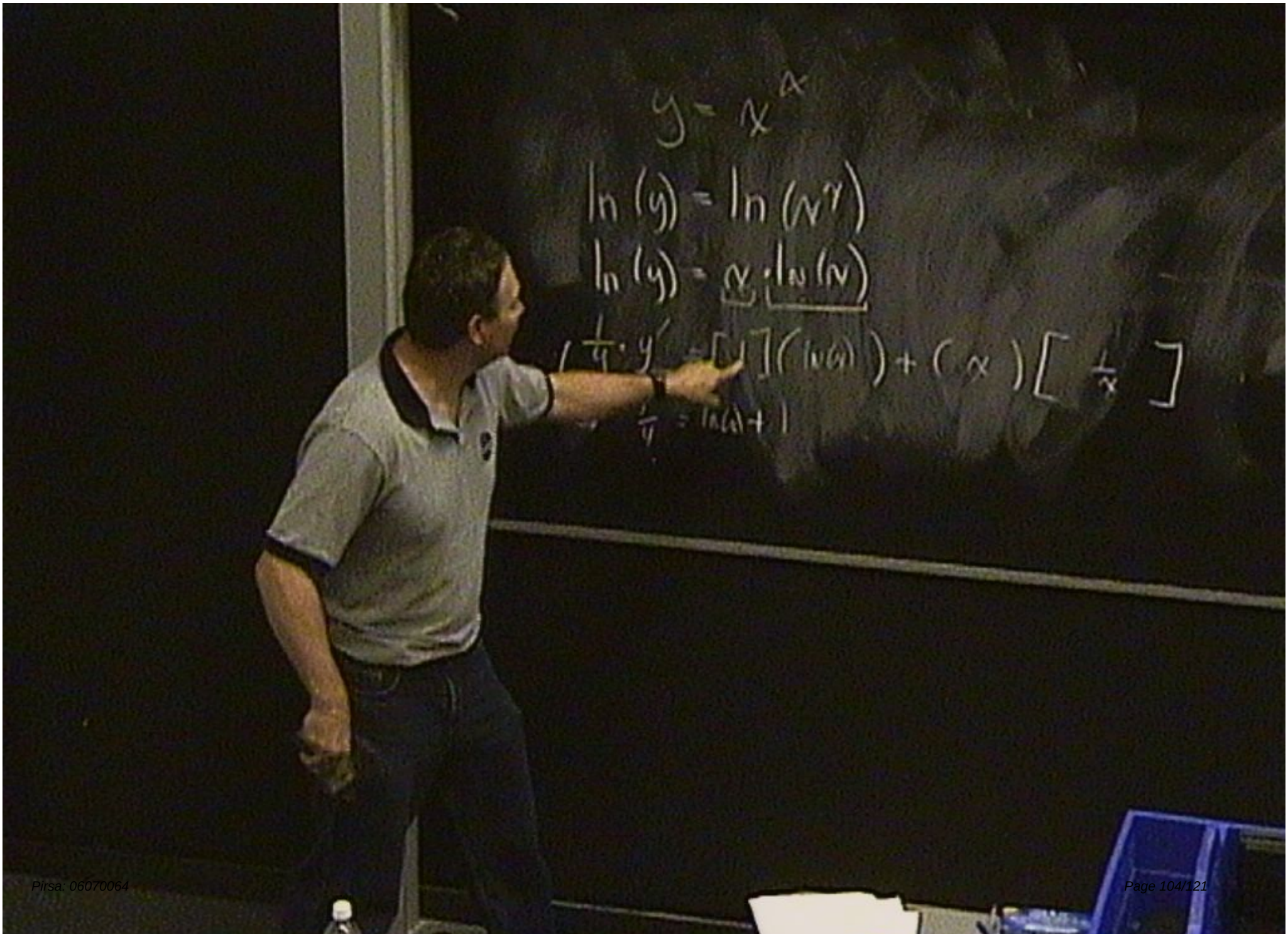
$$\ln(y) = \underbrace{x}\cdot\underbrace{\ln(x)}$$

$$\frac{1}{y}\cdot y' = [1](\ln(x)) + (x)\left[\frac{1}{x}\right]$$

$$\frac{y'}{y} = \ln(x) + 1$$

$$y' = y\left[\ln(x) + 1\right]$$

$$y' = x^{x}\left(\ln(x) + 1\right)$$


y = x^α
ln(y) = ln(x^α)
ln(y) = α · ln(x)
(1/y · y') = [ ](ln(x)) + (α)[1/x]
1/y = ln(x) + 1

$$y = x^x$$

$$\ln(y) = \ln(x^x)$$

$$\ln(y) = \underbrace{x}\cdot\underbrace{\ln(x)}$$

$$\frac{1}{y}\cdot y' = [1](\ln(x)) + (x)\left[\frac{1}{x}\right]$$

$$\frac{y'}{y} = \ln(x) + 1$$

$$y = x^{x}$$

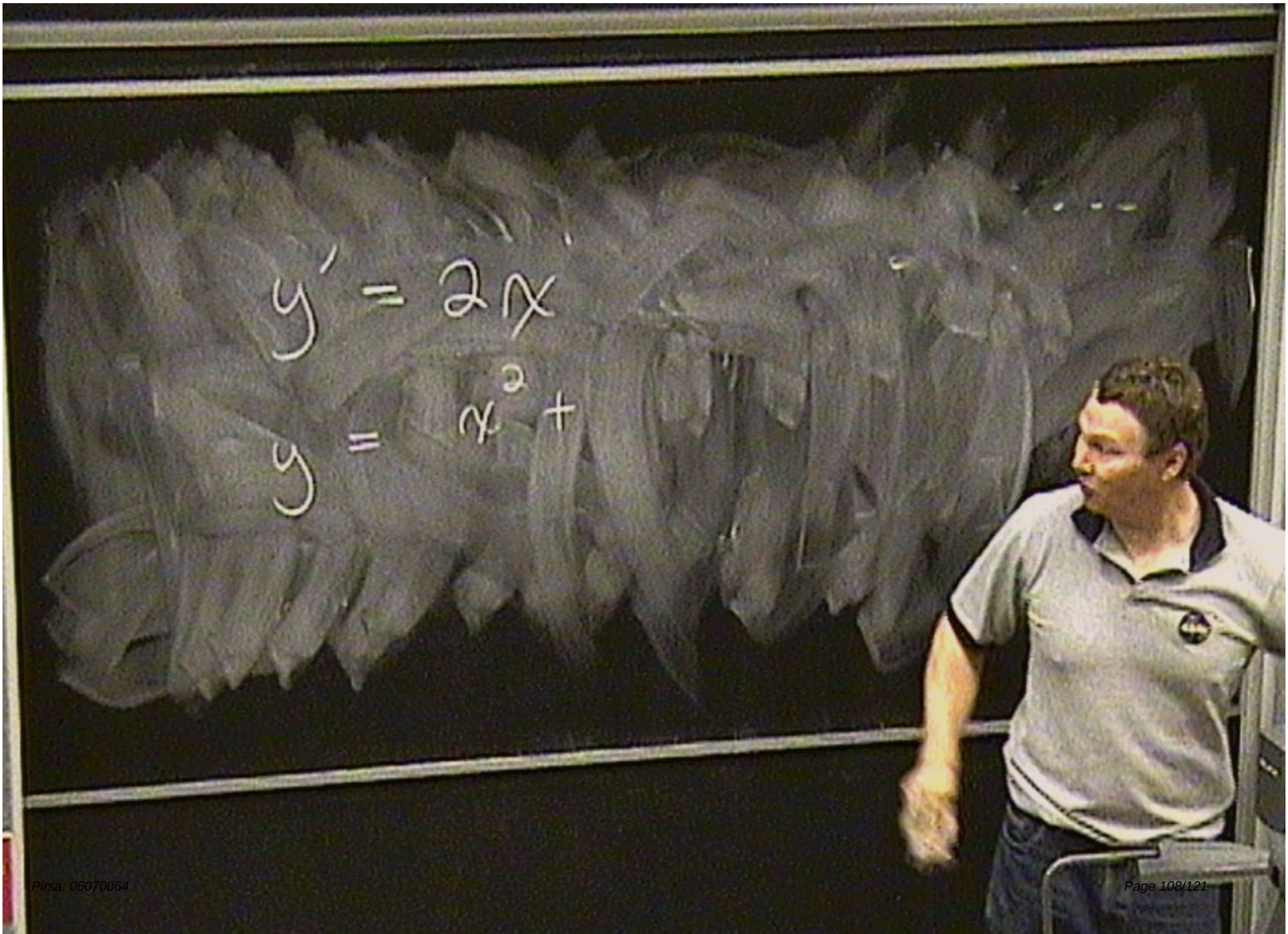
$$\ln(y) = \ln(x^{x})$$

$$\ln(y) = \underbrace{x}\cdot\underbrace{\ln(x)}$$

$$\frac{1}{y}\cdot y' = [1](\ln(x)) + (x)\left[\frac{1}{x}\right]$$

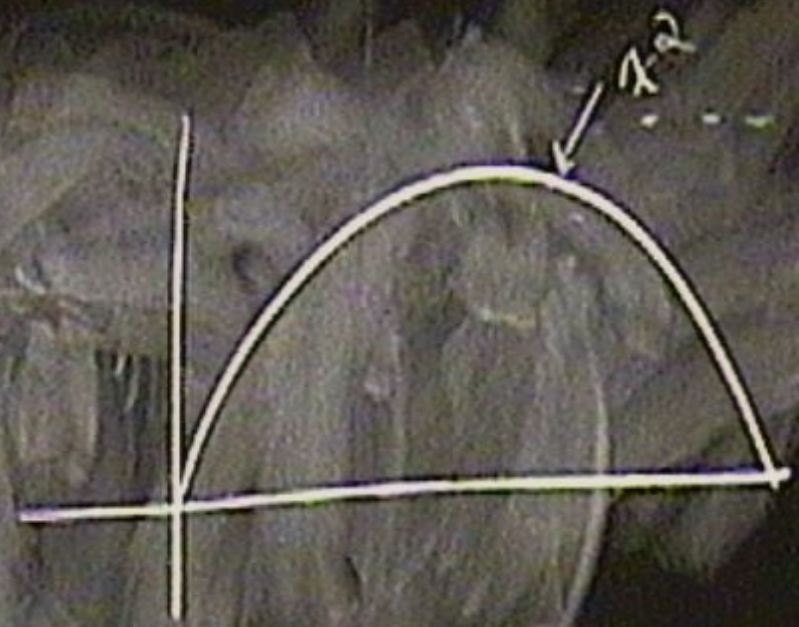
$$\frac{y'}{y} = \ln(x) + 1$$

$$y' = 2x$$


y' = 2x
y = x^2 +

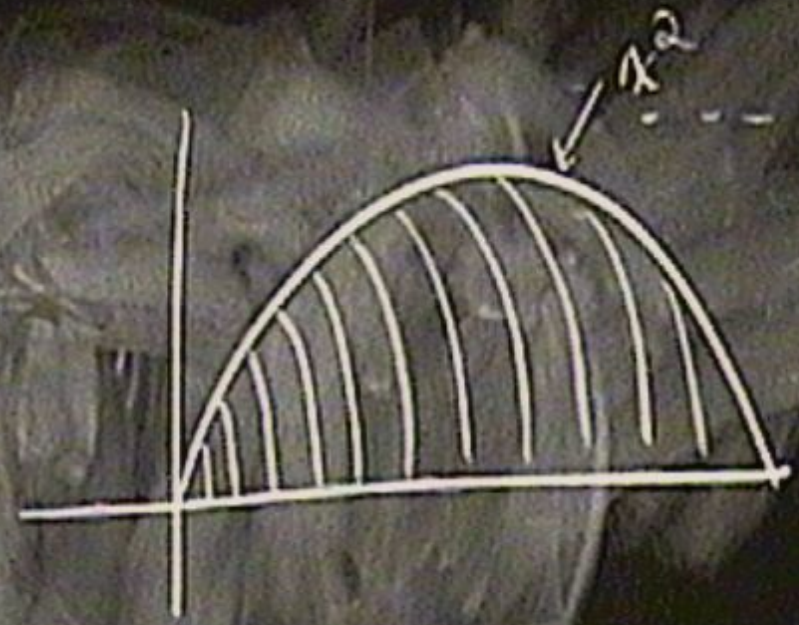
$$y' = 2x$$

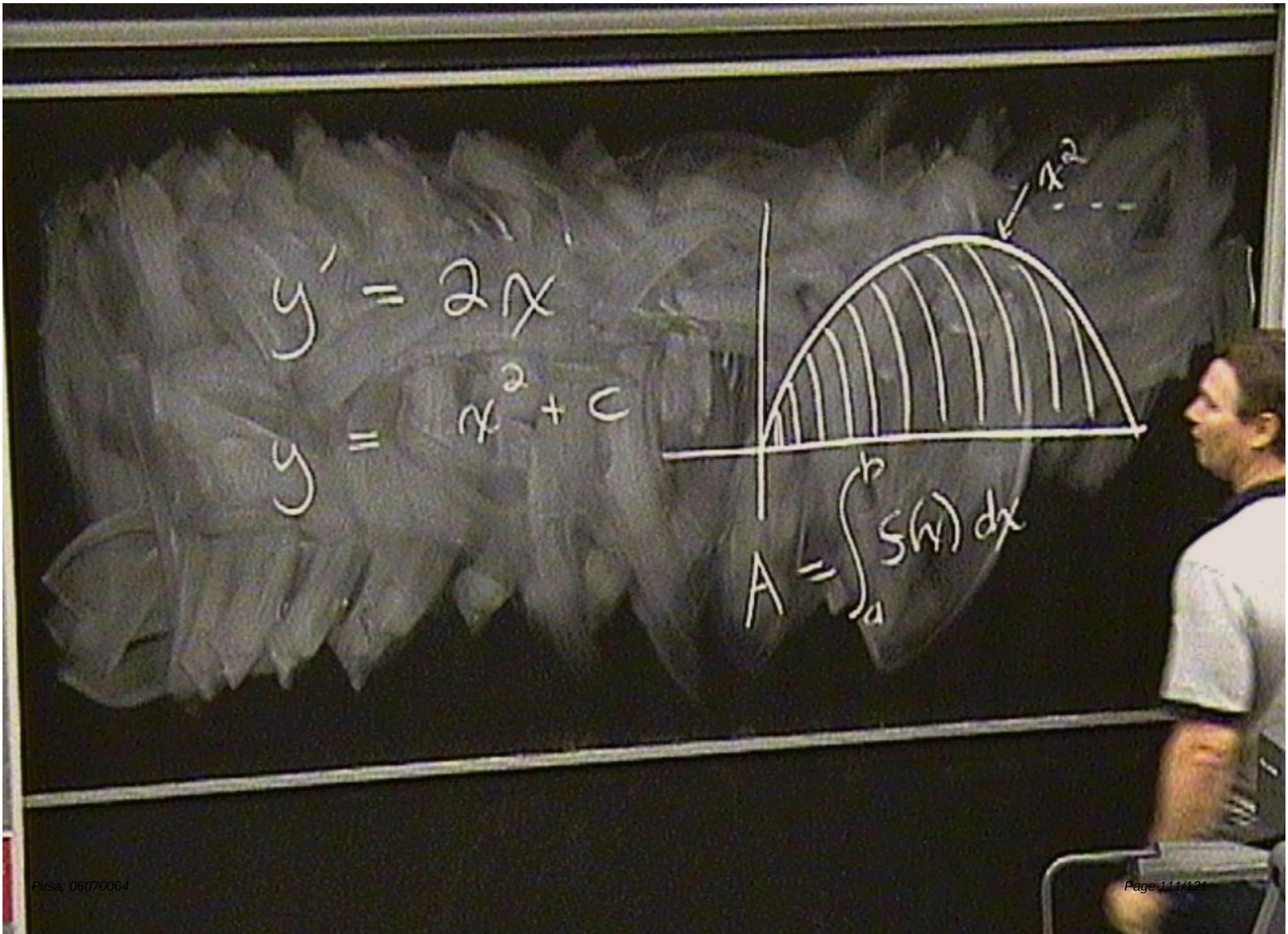
$$y = x^2 + c$$

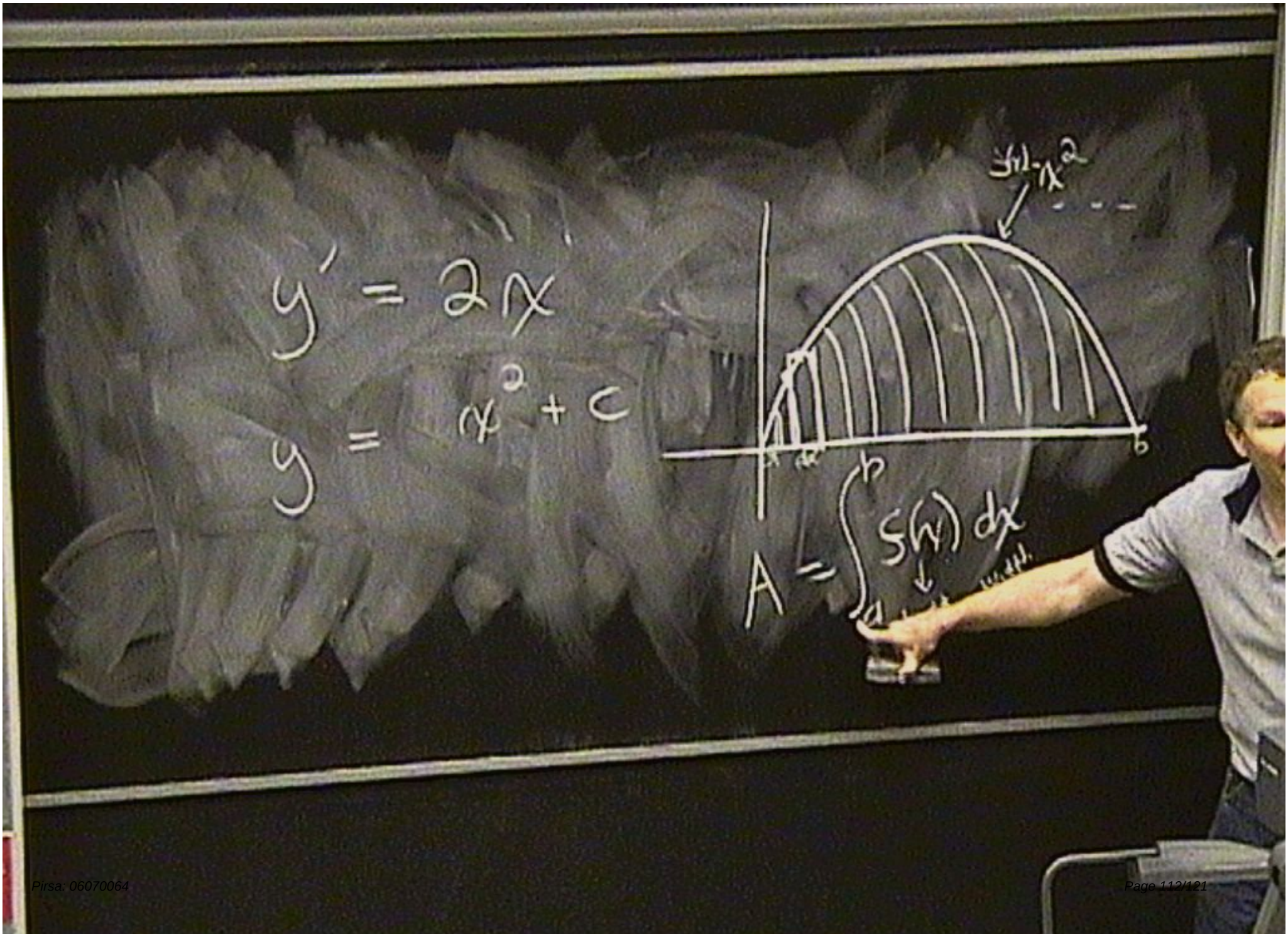


$$y' = 2x$$

$$y = x^2 + c$$



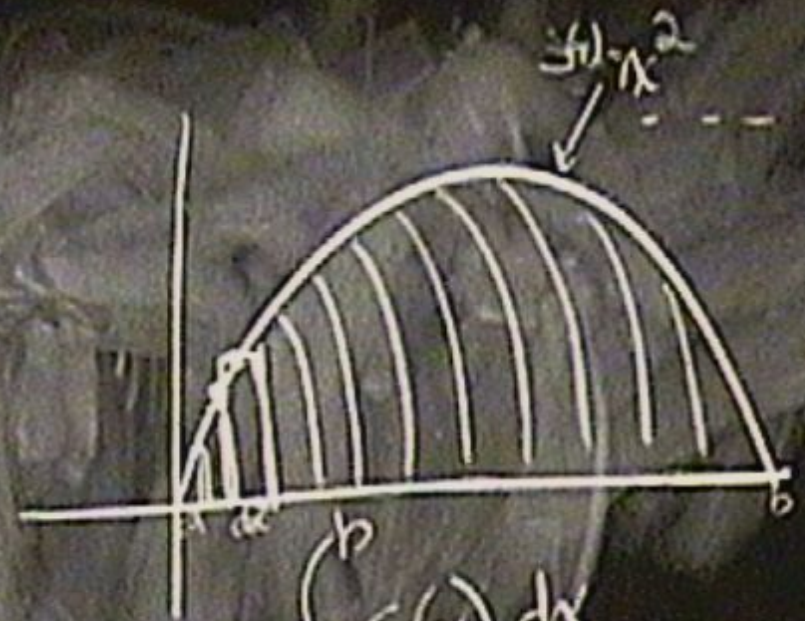

$y' = 2x$
$y = x^2 + c$
x^2
$A = \int_a^b f(x)\,dx$


y' = 2x
y = x^2 + c
f(x) = x^2
A = ∫ f(x) dx

$$y' = 2x$$

$$y = x^2 + c$$

$$F(b) - F(a)$$

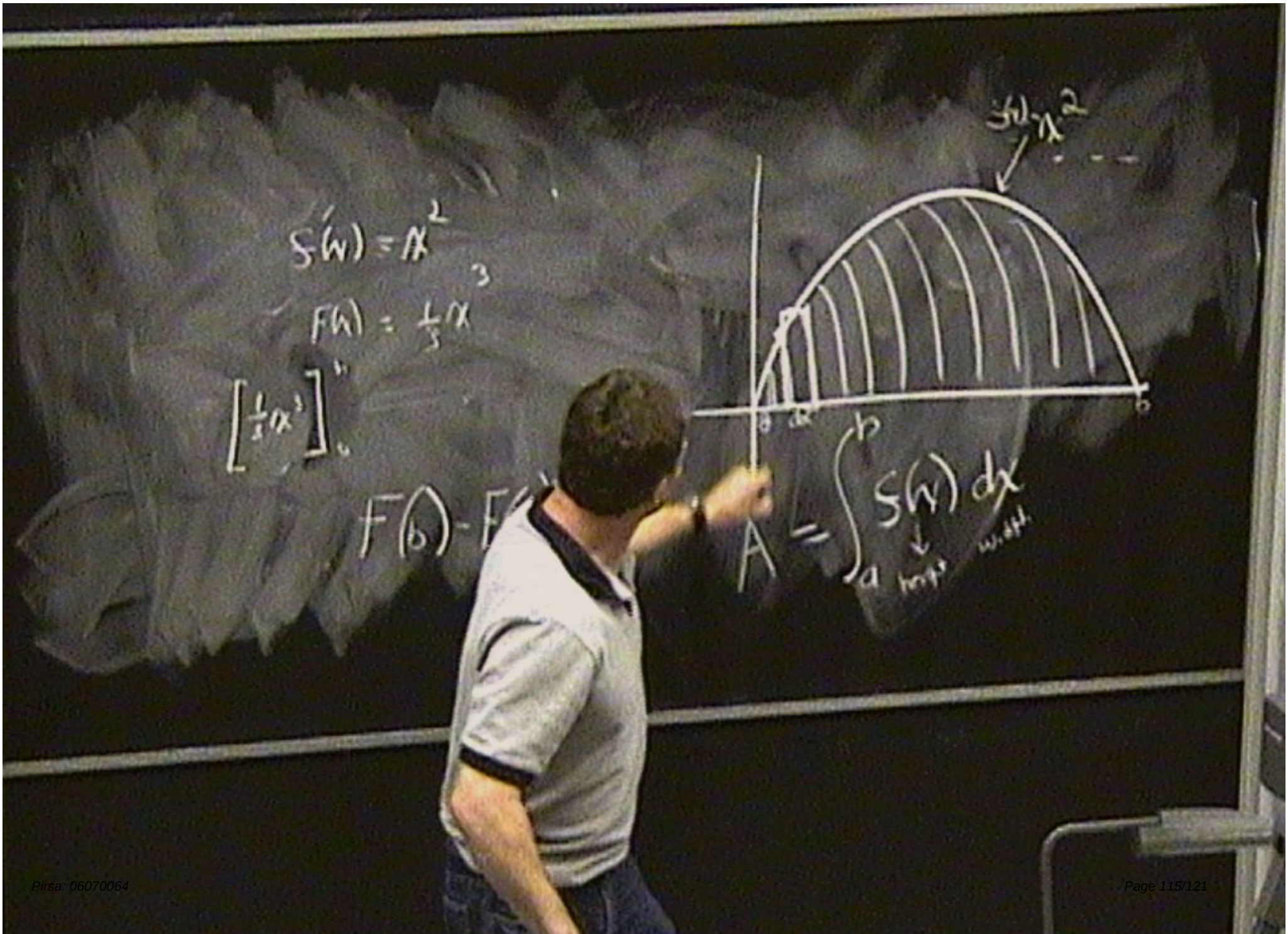


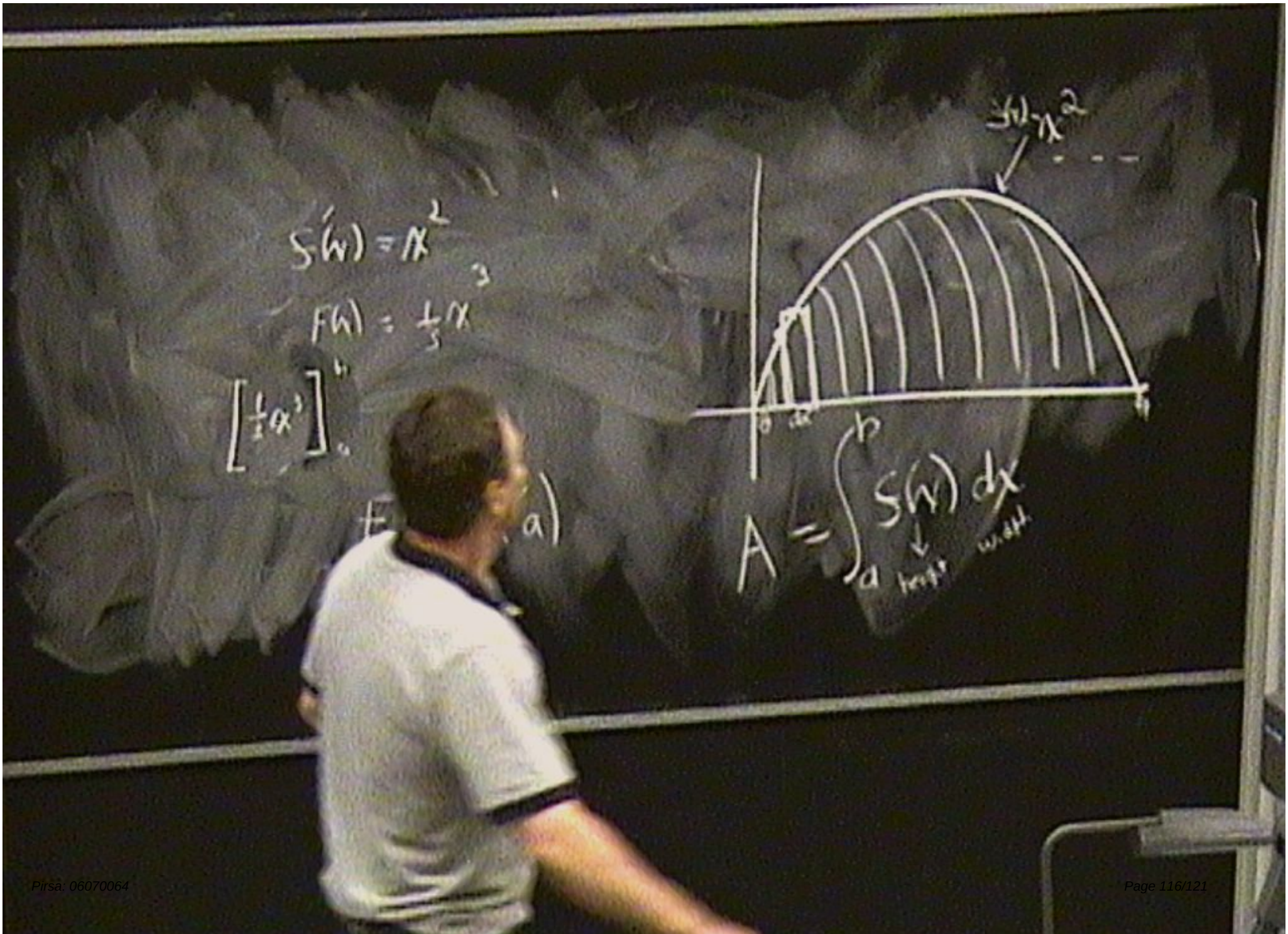
$$A = \int_a^b \underbrace{f(x)}_{\text{height}} \underbrace{dx}_{\text{width}}$$

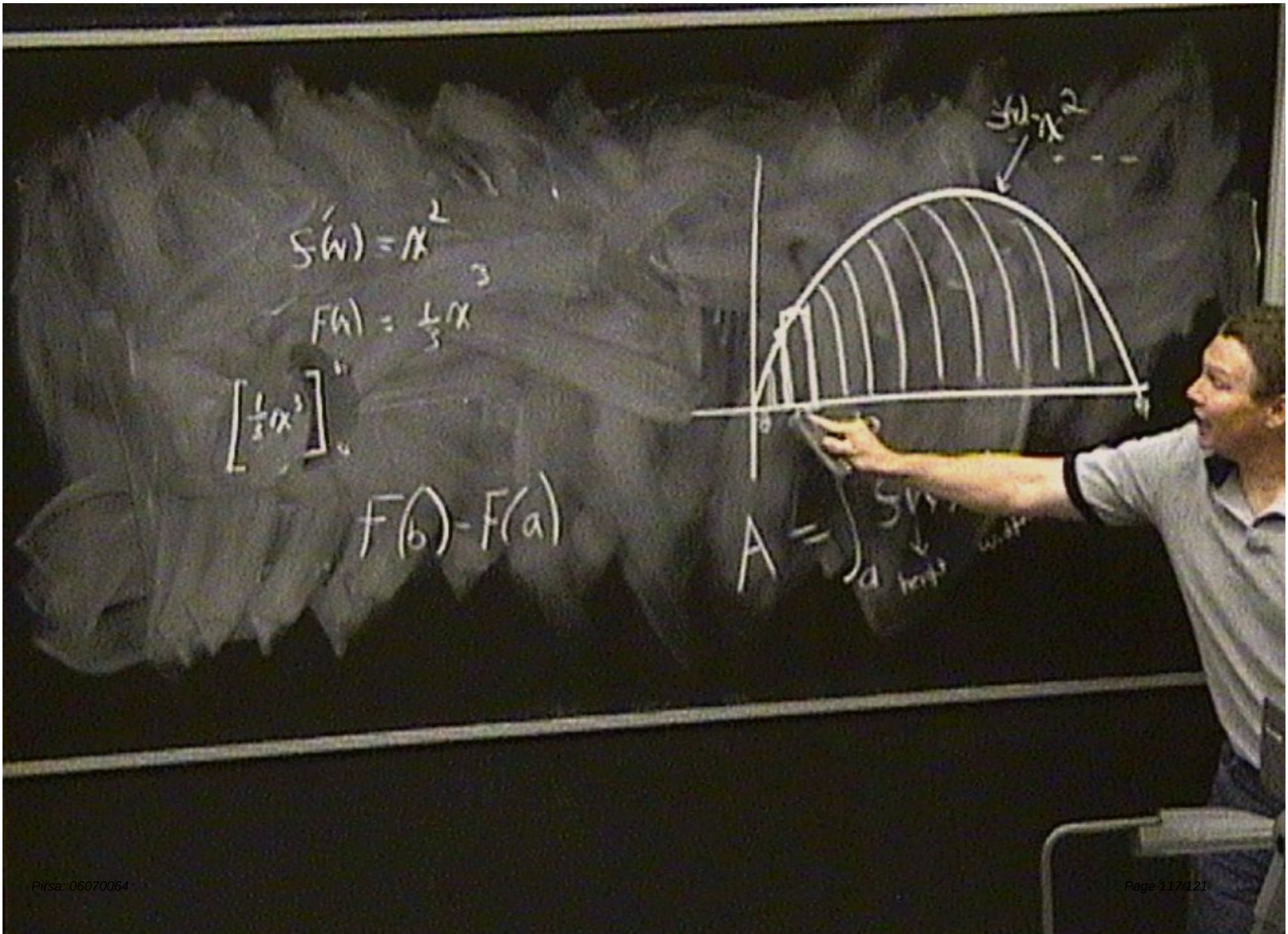
$$F(x) = \frac{1}{3}x^3$$

$$F(b) - F(a)$$

A


f(x) = x^2
f'(x) = x^2
F(x) = 1/3 x^3
[1/3 x^3]
F(b) - F
a
b
dx
A = �int_a^b f(x) dx
height
width


f(x) = x^2
F(x) = 1/3 x^3
A = ∫_a^b f(x) dx
height
width

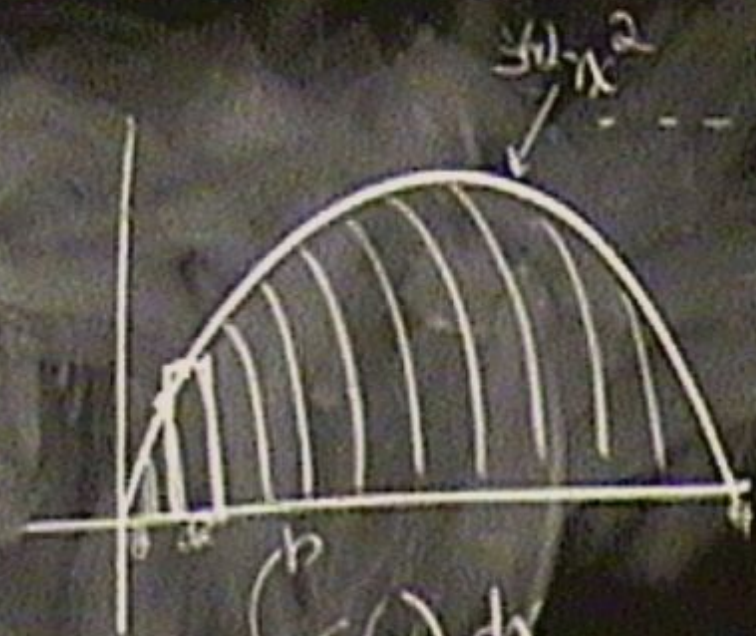

f(x) = x^2
F(x) = 1/3 x^3
[1/3 x^3]
F(b) - F(a)
f(x) = x^2
A = ∫_a f(x)

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

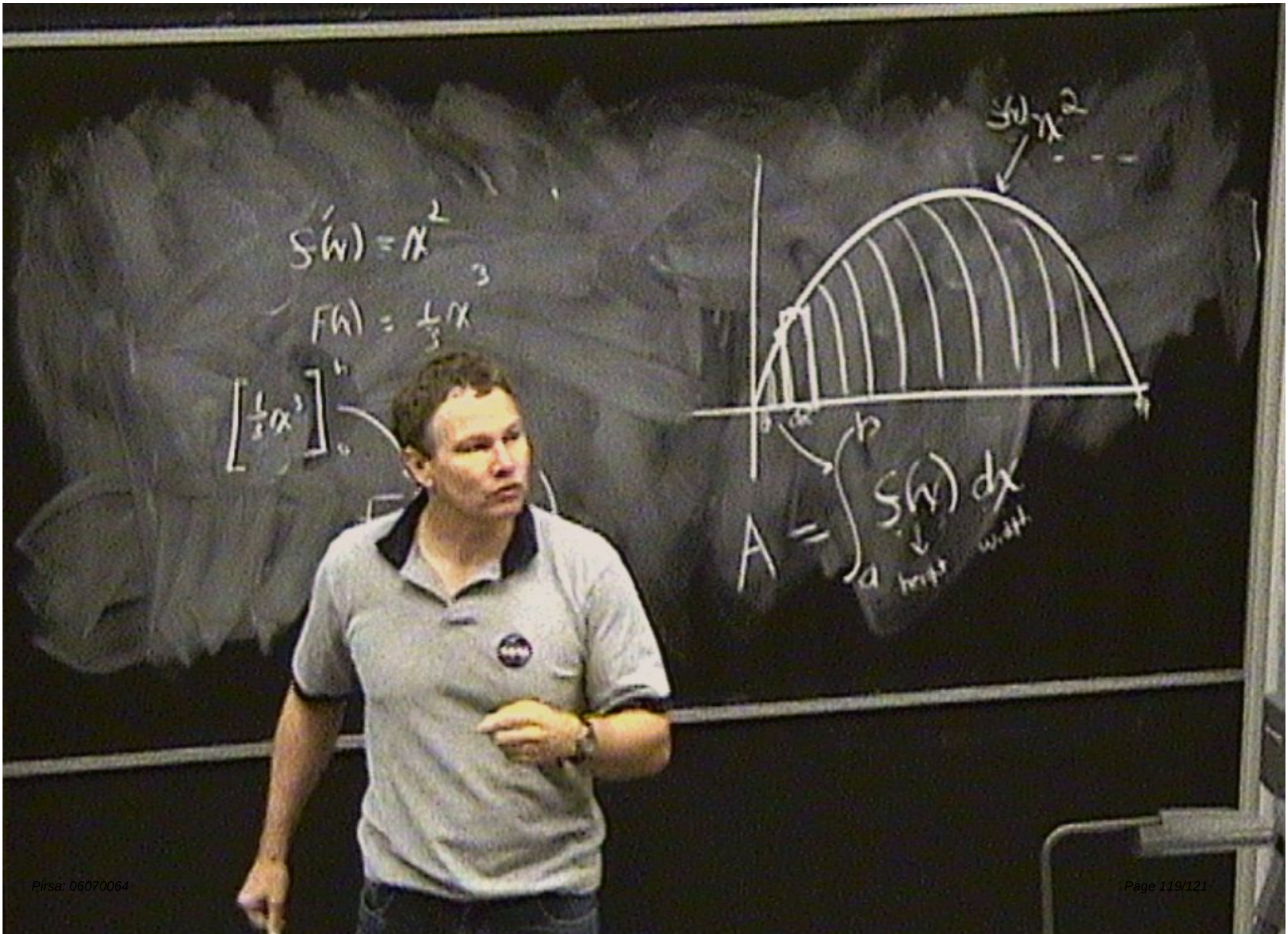
$$F(x) = \frac{1}{3}x^3$$

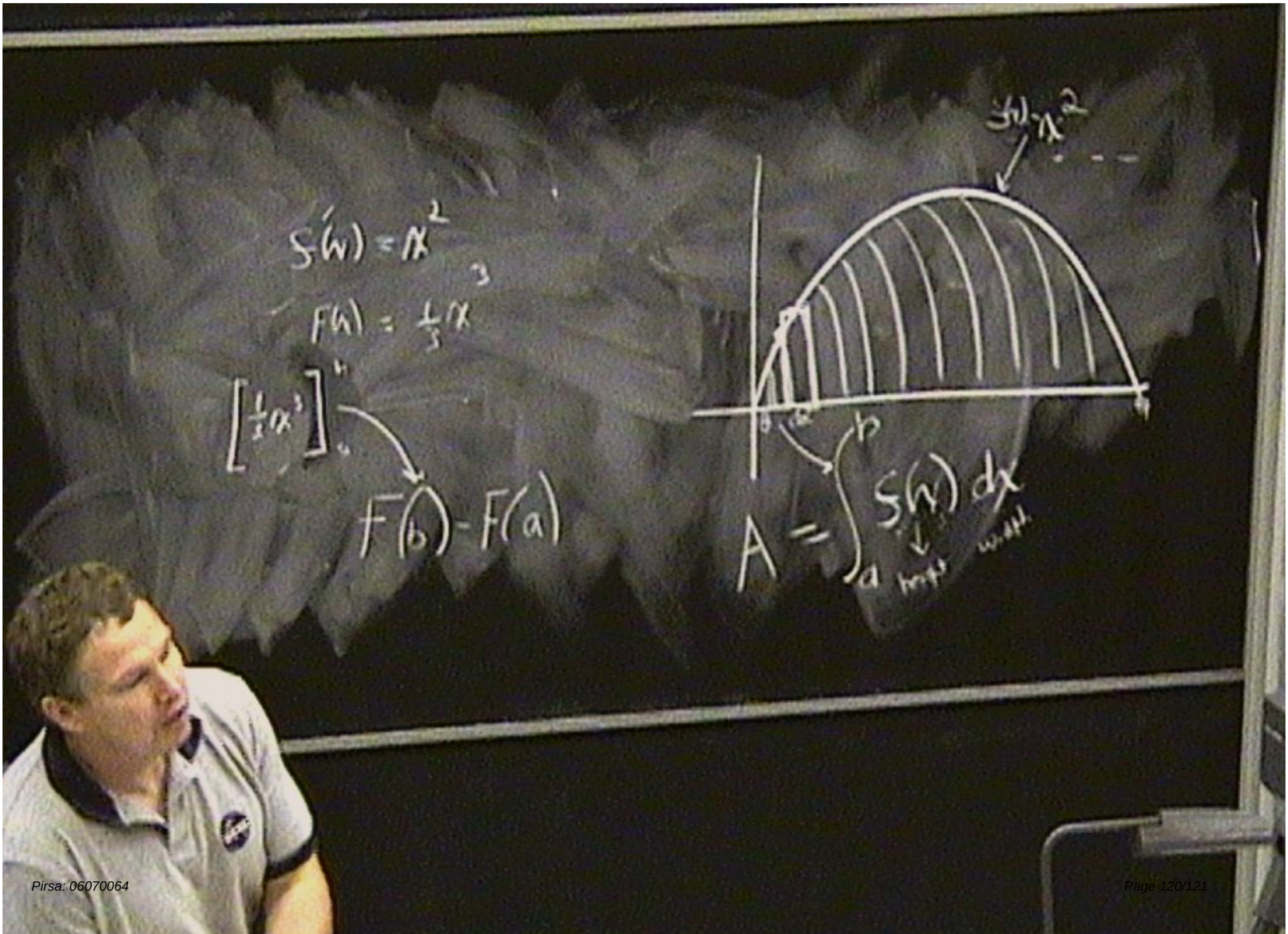
$$\left[\frac{1}{3}x^3\right]_a^b$$

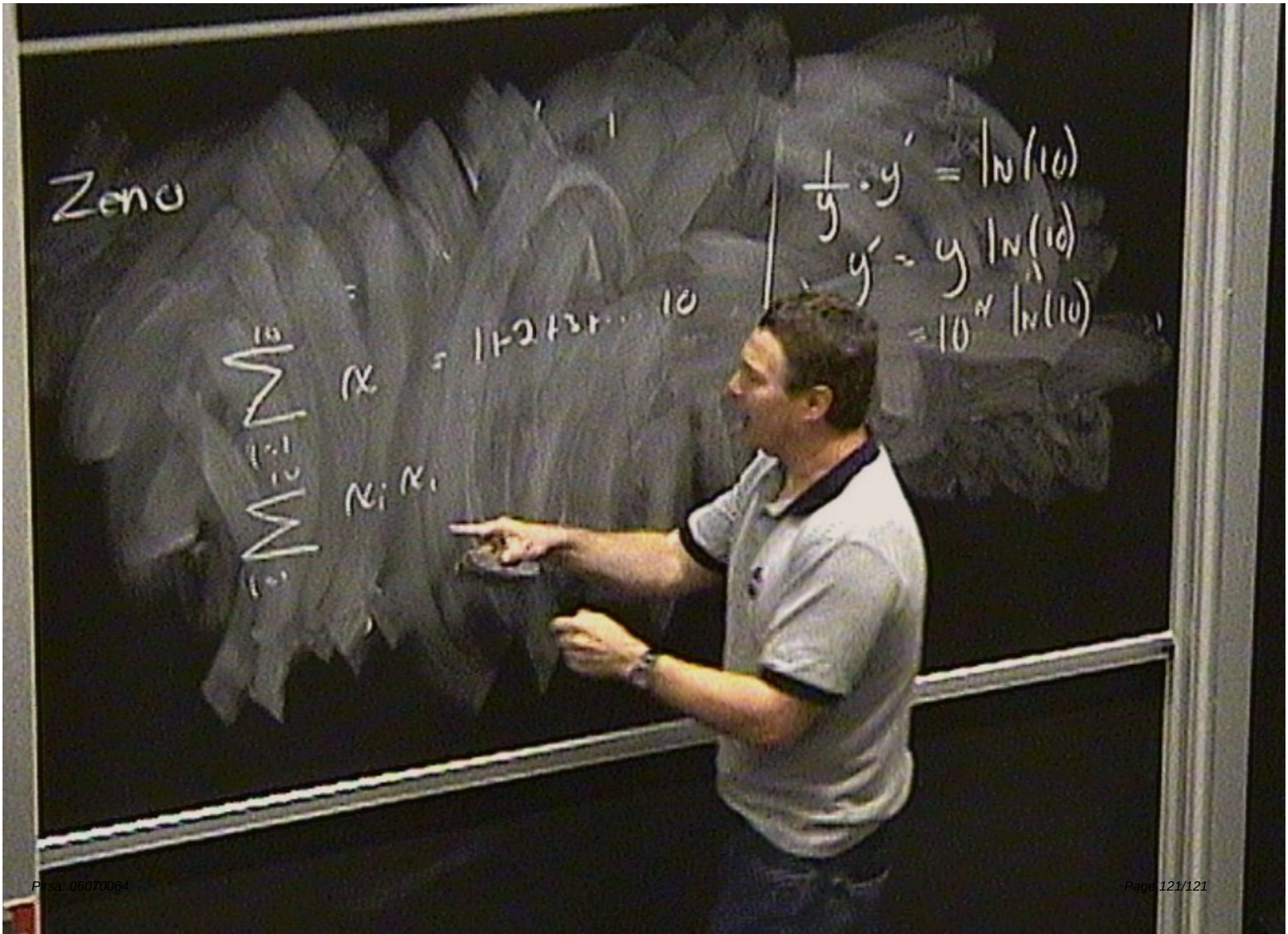
$$F(b) - F(a)$$



$$A = \int_a^b \underbrace{f(x)}_{\text{height}} \, \underbrace{dx}_{\text{width}}$$


f(x) = x^2
F(x) = 1/3 x^3
f(x) = x^2
A = ∫_a^b f(x) dx
height
width


f(x) = x^2
F(x) = 1/3 x^3
[1/3 x^3]
F(b) - F(a)
f(x) = x^2
A = ∫_a^b f(x) dx


Zeno
$\frac{1}{y} \cdot y' = \ln(10)$
$y' = y \ln(10)$
$= 10^x \ln(10)$
$\sum_{i=1}^{10} x = 1+2+3+\dots 10$
$\sum_{i=1}^{10} x_i x_i$