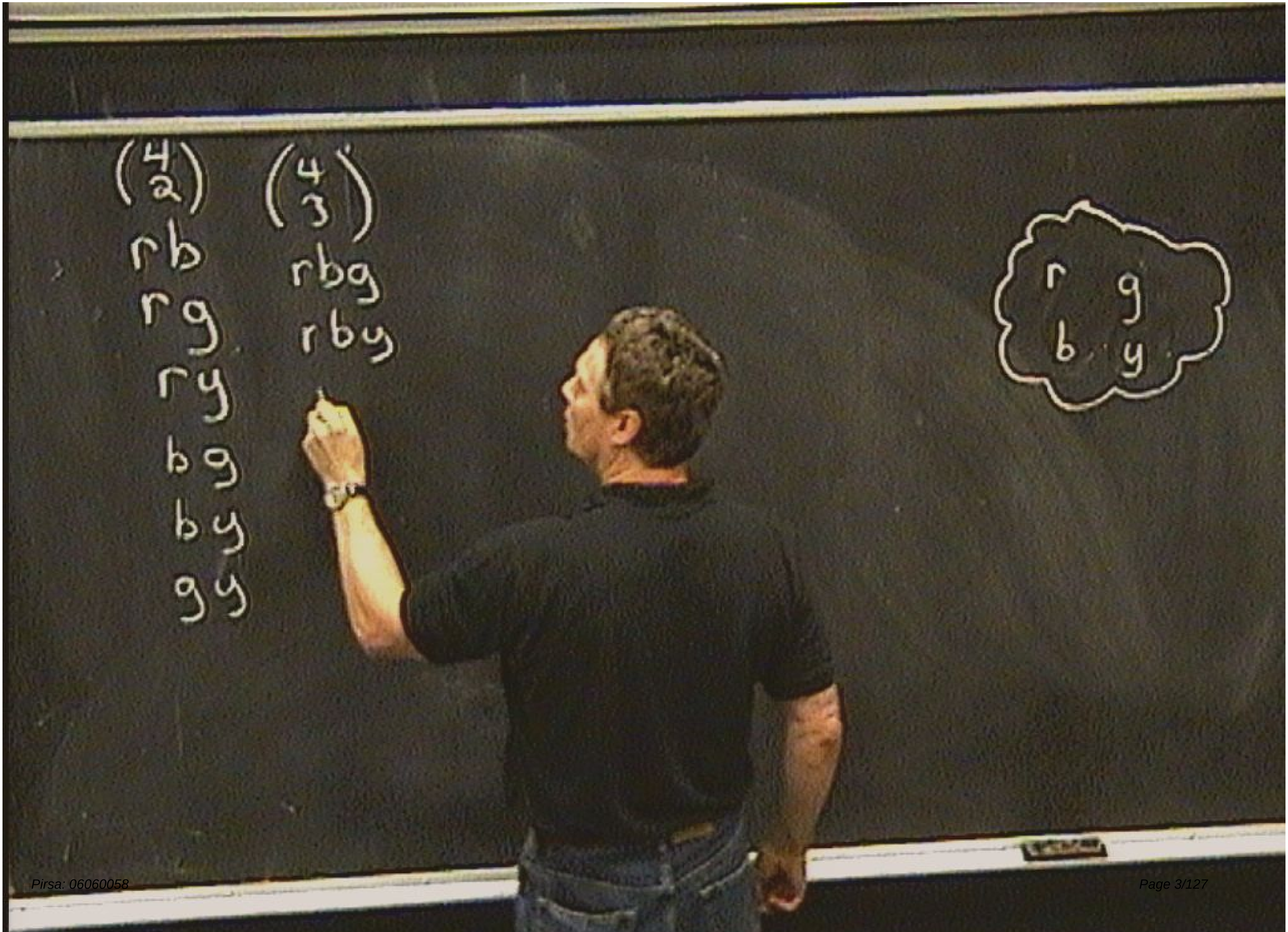
Title: The Weird World of Quantum Physics

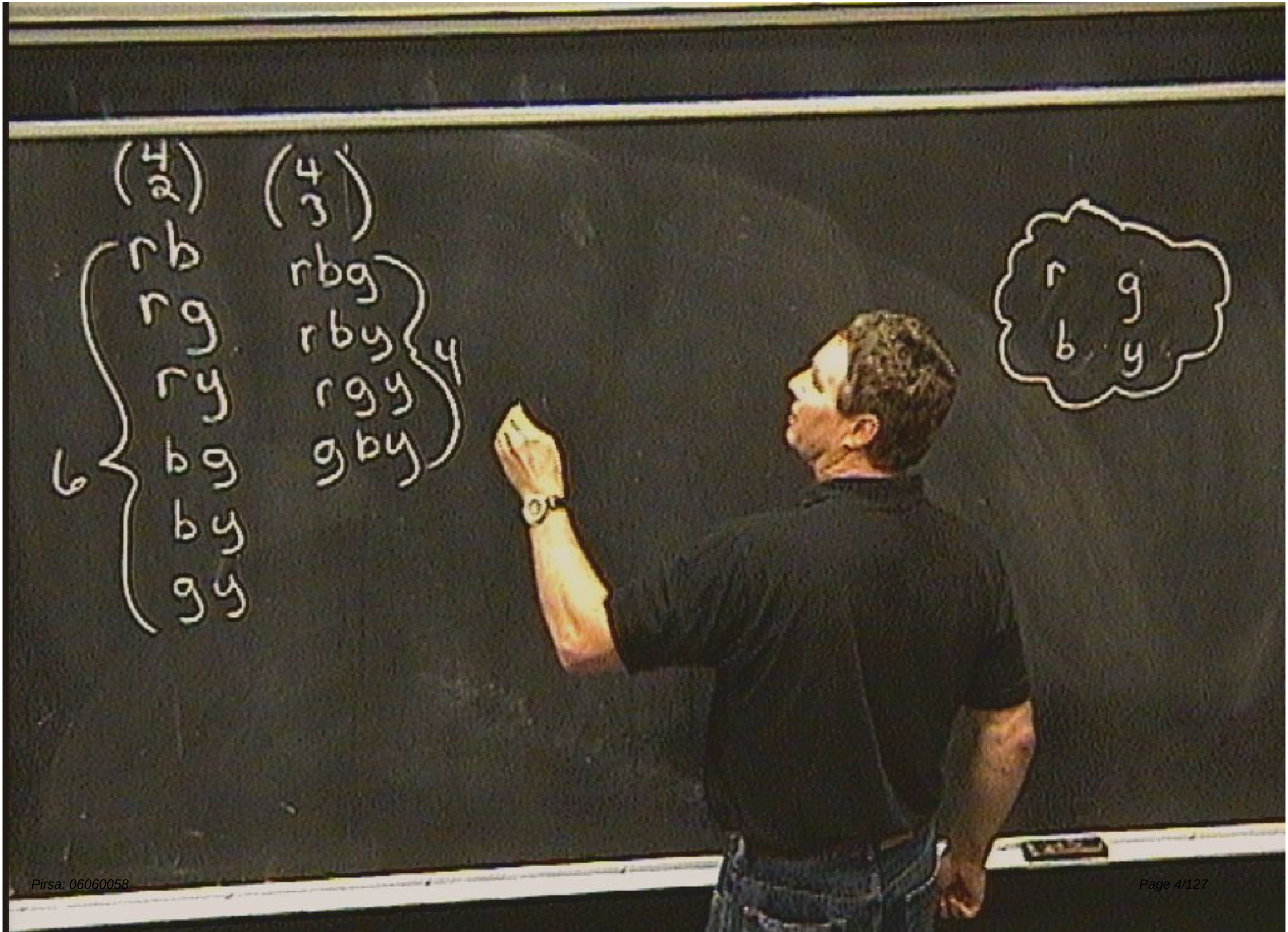
Date: Jun 25, 2006 03:00 PM

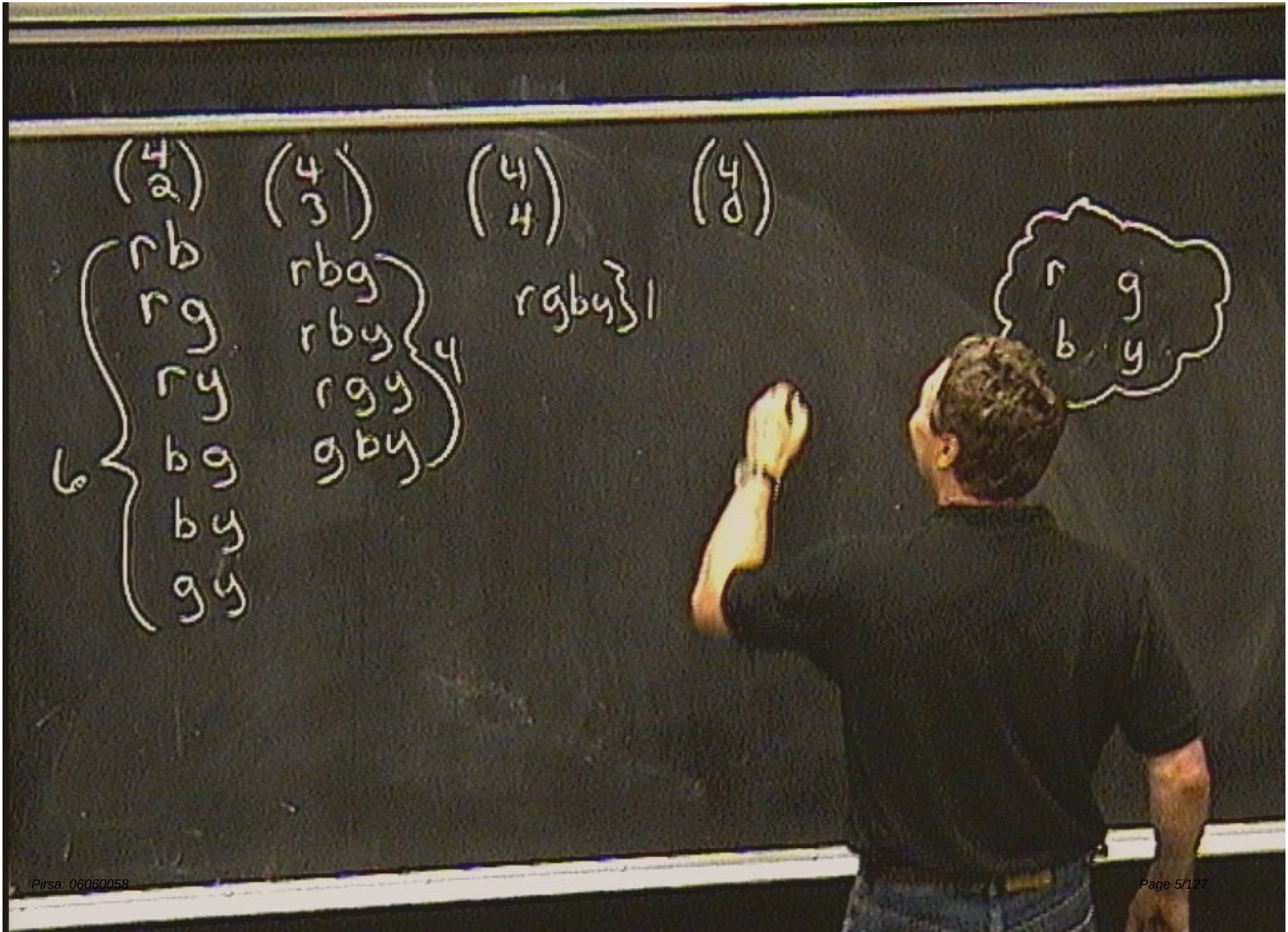
URL: http://pirsa.org/06060058

Abstract:


rb
rg
ry
bg
by
gy
r g
b y


(4 2)
rb
rg
ry
bg
by
gy
(4 3)
rbg
rby
r g
b y

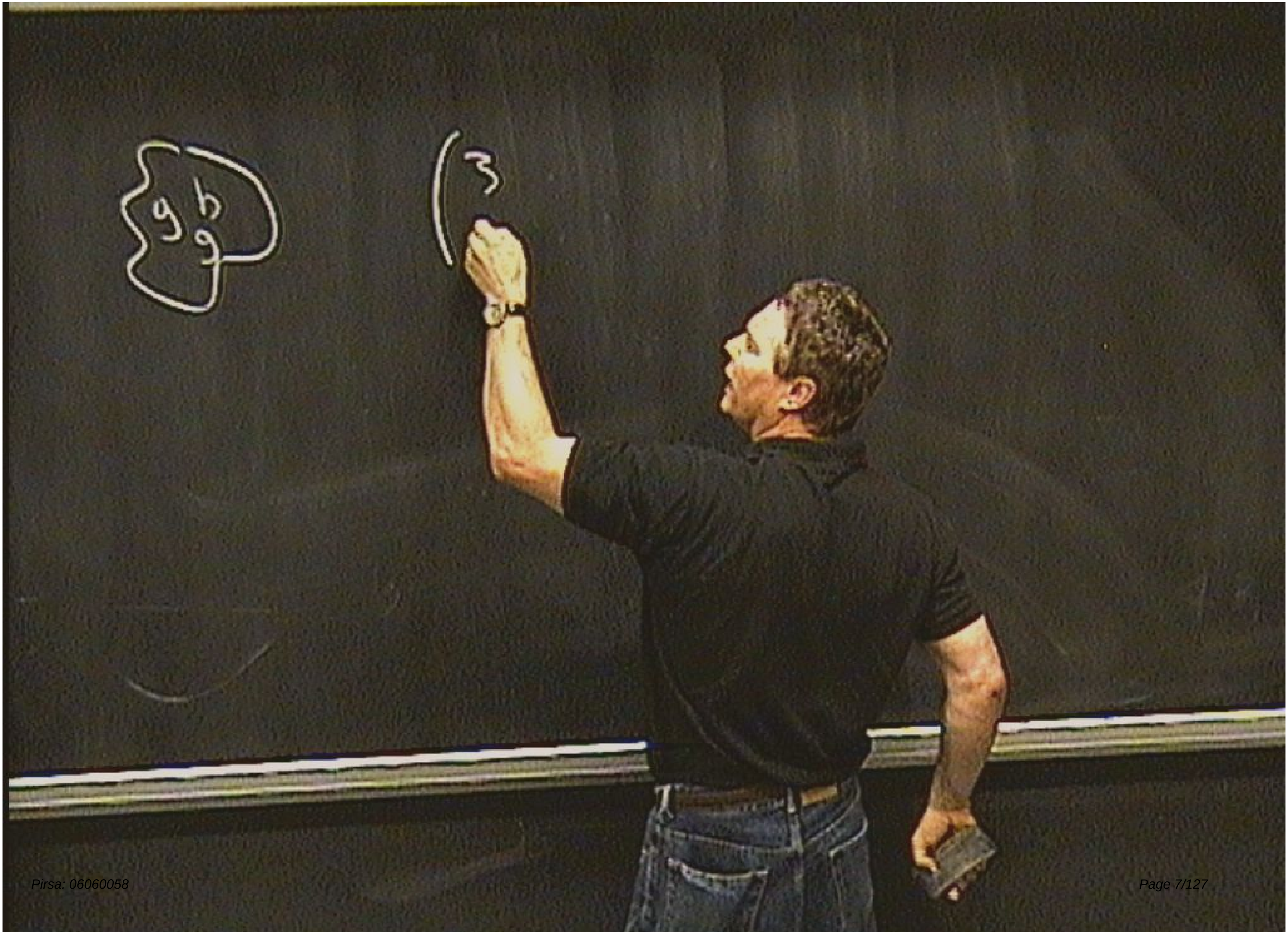

$\binom{4}{2}$
$\binom{4}{3}$
rb
rg
ry
bg
by
gy
6
rbg
rby
rgy
gby
4
r g
b y

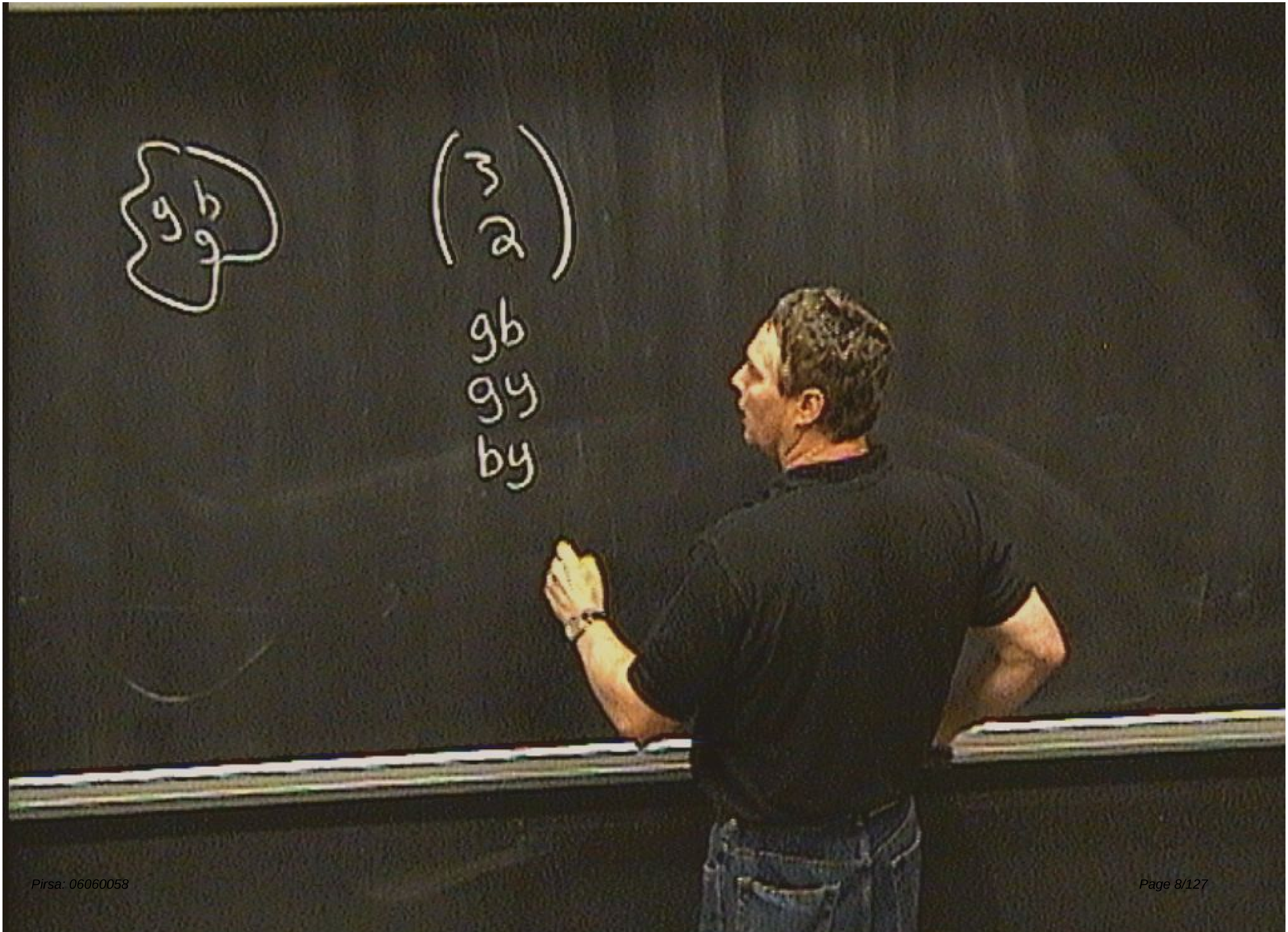

(4 2) (4 3) (4 4) (4 0)
rb
rg
ry
6 bg
by
gy
rbg
rby
rgy
gby
4
rgby 1
r g
b y

$\binom{4}{2}$	$\binom{4}{3}$	$\binom{4}{4}$	$\binom{4}{0}$
rb	rbg	rgby } 1	1
rg	rby		
ry	rgy		
bg	gby		
by			
gy			

$6 \left\{ \begin{matrix} rb \\ rg \\ ry \\ bg \\ by \\ gy \end{matrix} \right.$ $\qquad \left. \begin{matrix} rbg \\ rby \\ rgy \\ gby \end{matrix} \right\} 4$

r g
b y



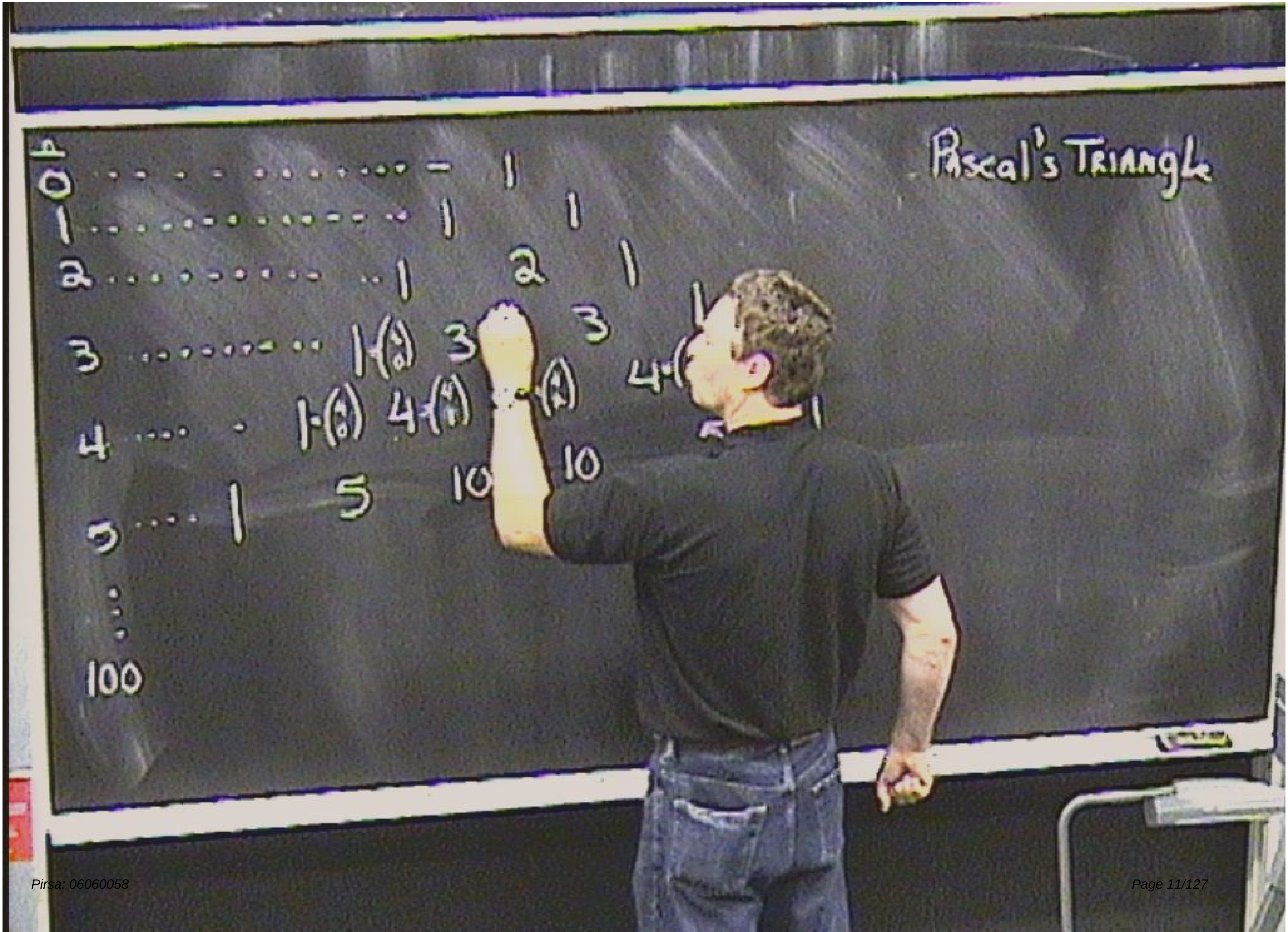

y b
g
3
2
gb
gy
by

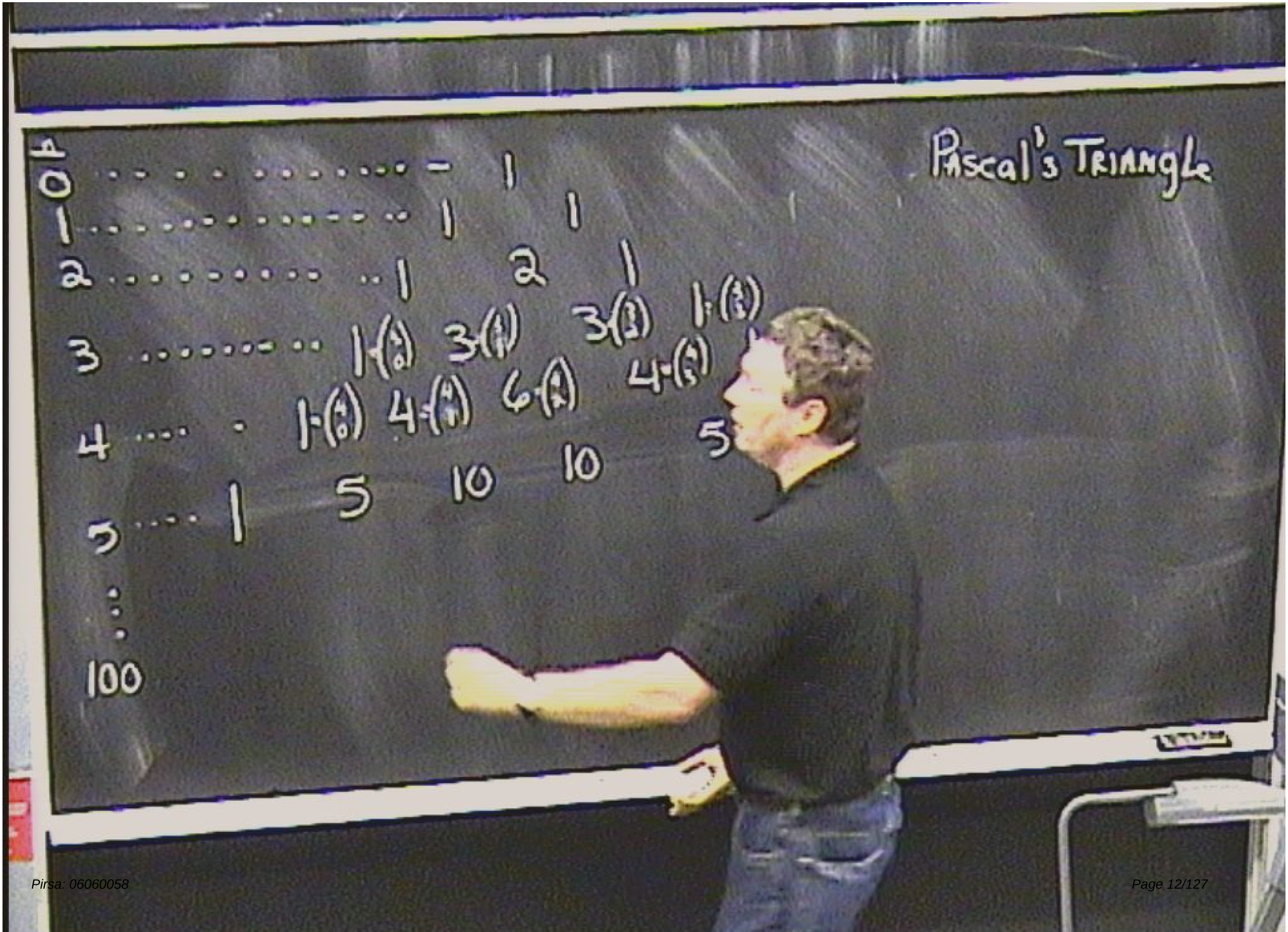
$$\binom{3}{2}$$

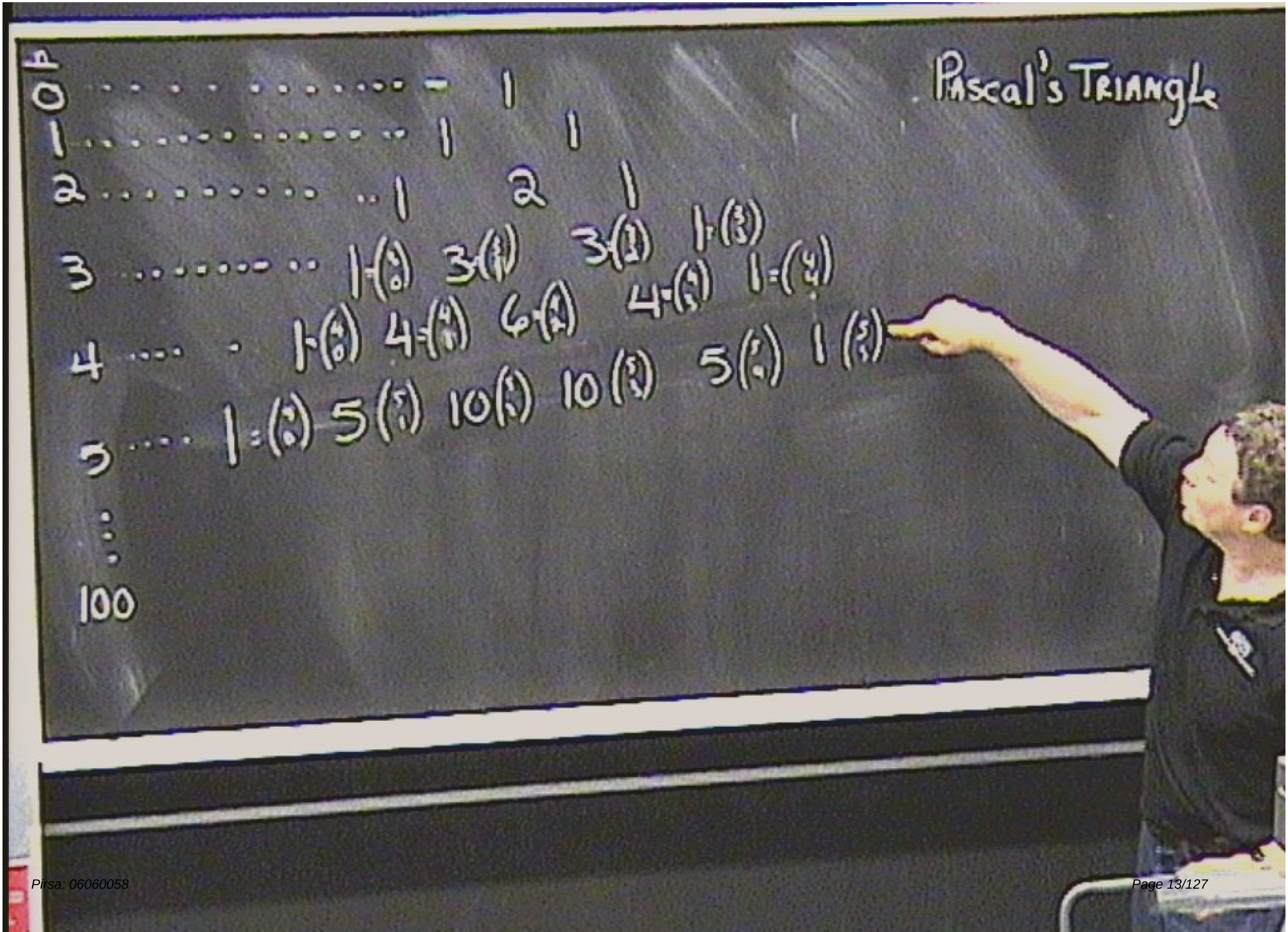
$$\left.\begin{array}{l} gb \\ gy \\ by \end{array}\right\} 3$$

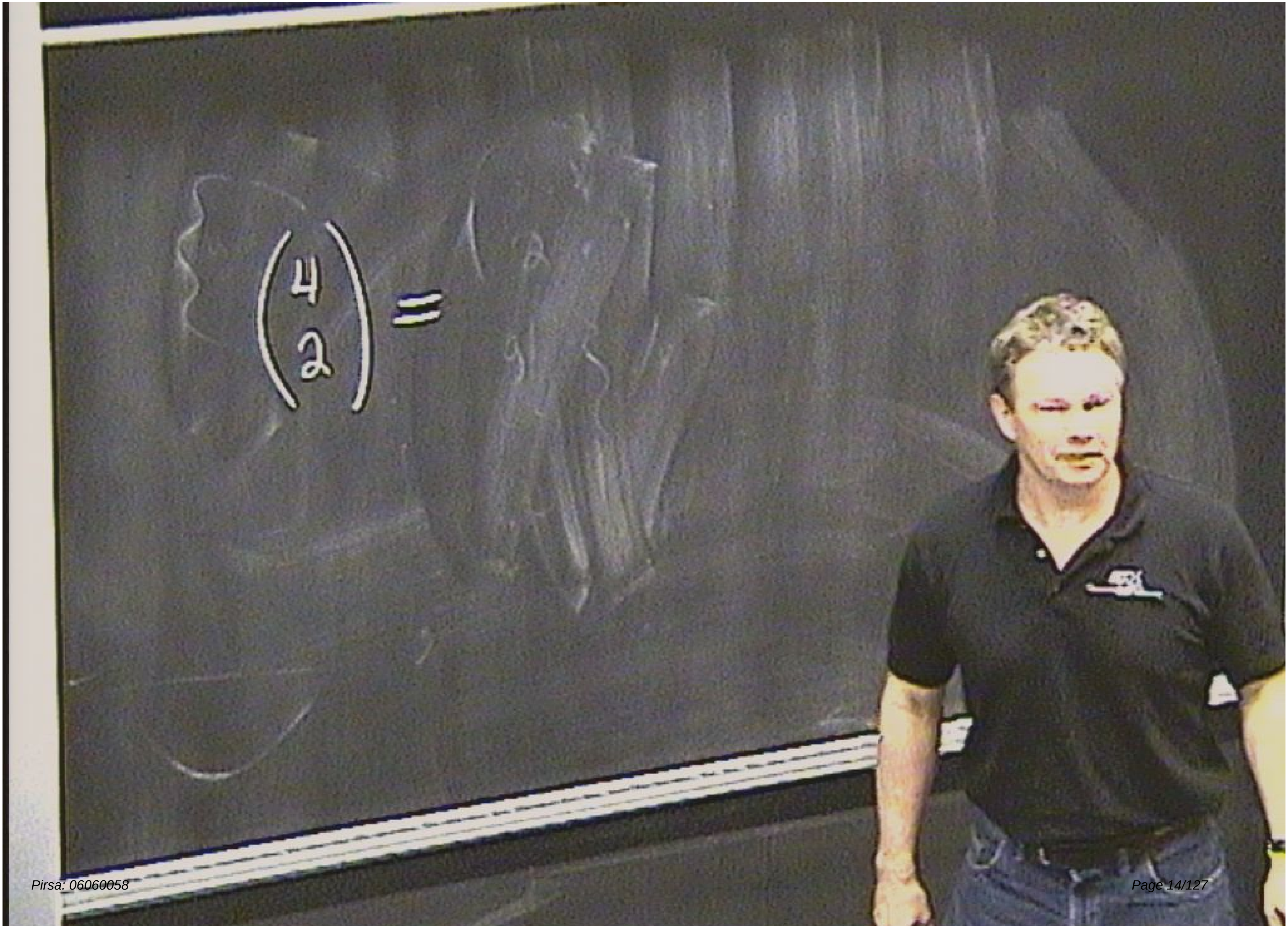
Pascal's Triang

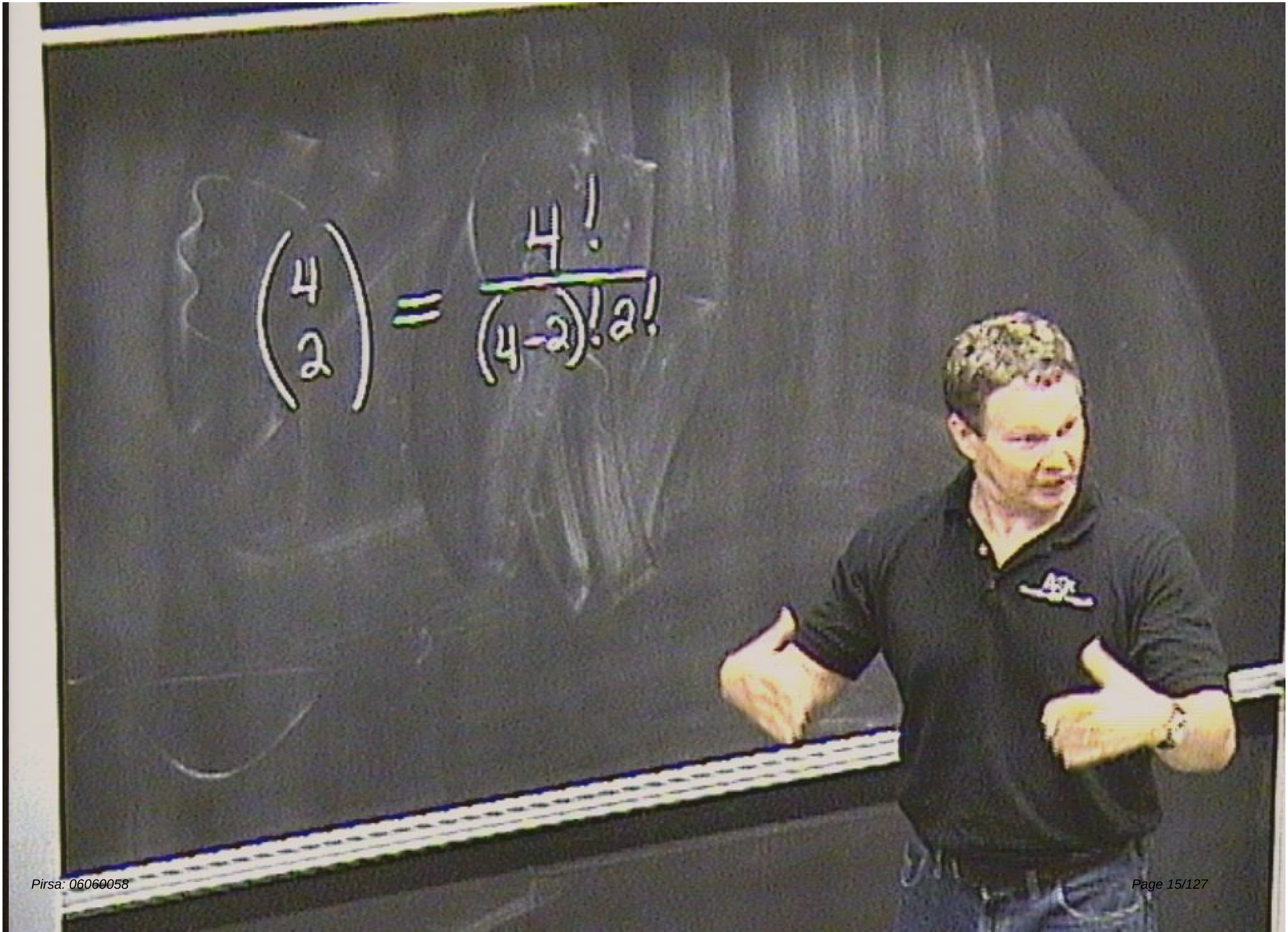
t						
0	1					
1	1	1				
2	1	2	1			
3	1	3	3	1		
4	1	4	6	4	1	
5	1	5	10	10	5	1
⋮						
100						

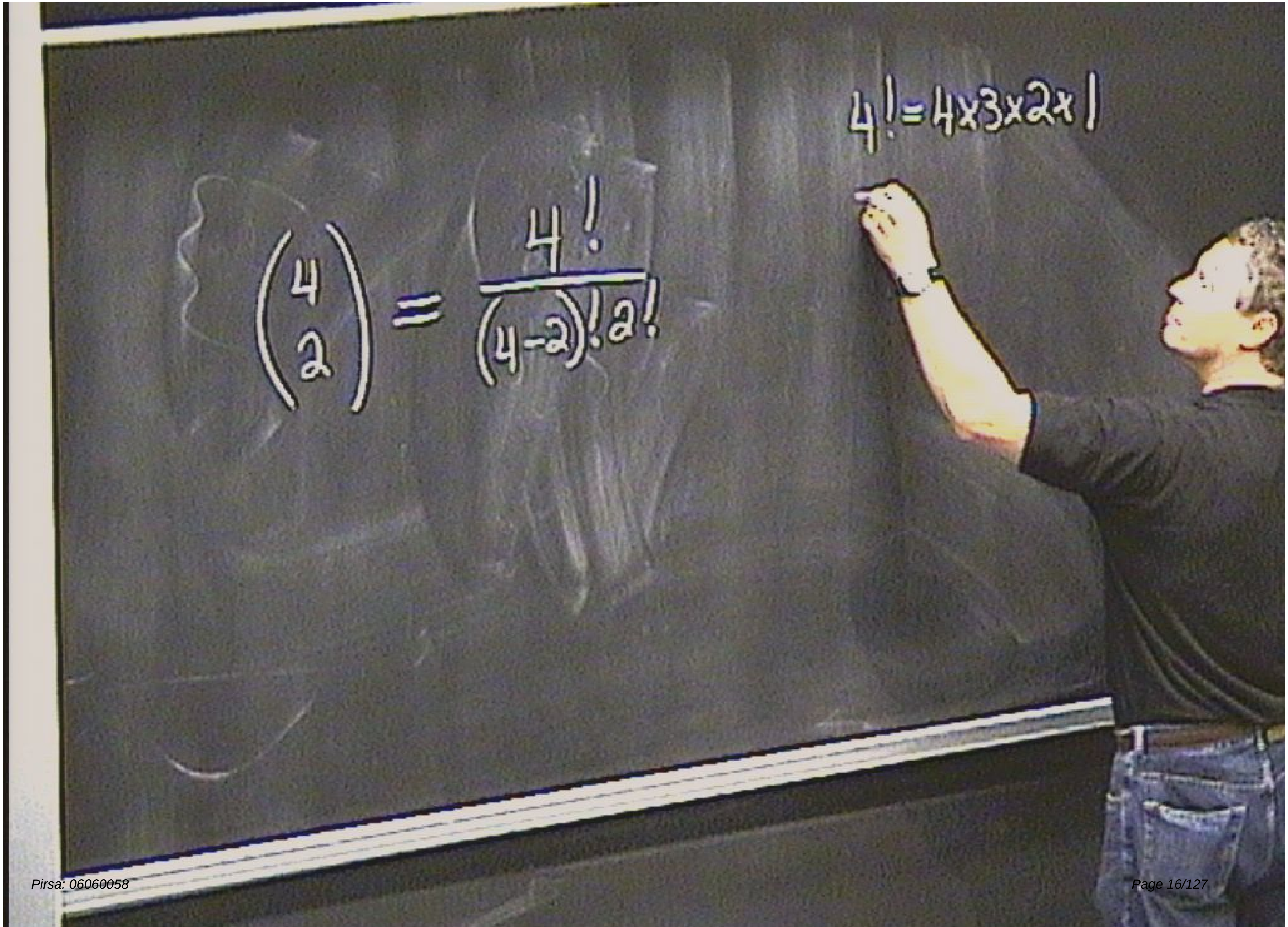

Pascal's Triangle
n
0 1
1 1 1
2 1 2 1
3 1 3 3 1
4 1 4 4 1
5 1 5 10 10
100

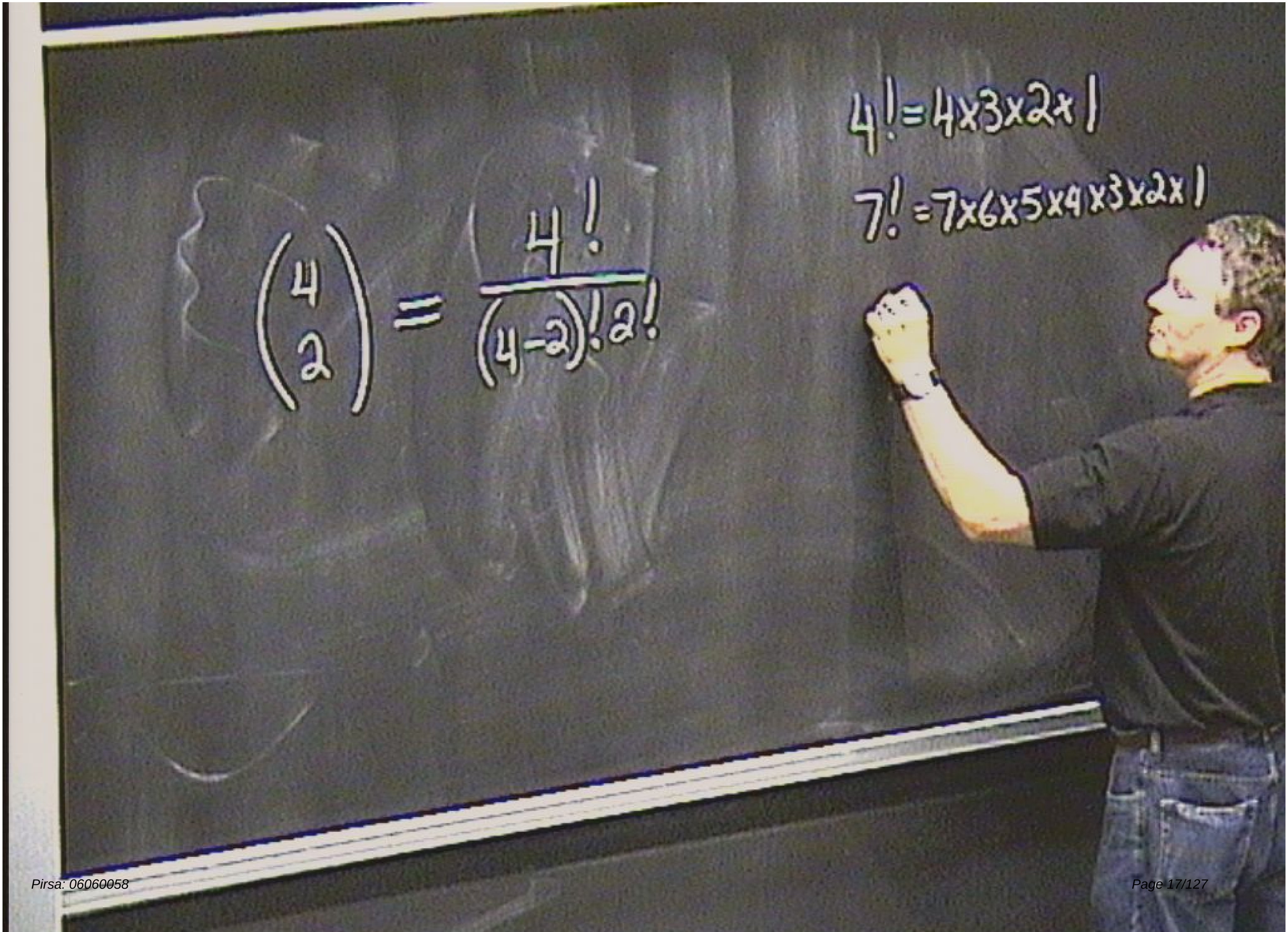

Pascal's Triangle
0 1
1 1 1
2 1 2 1
3 1 3 3 1
4 1 4 6 4
5 1 5 10 10 5
100


Pascal's Triangle
n
0 1
1 1 1
2 1 2 1
3 1 3 3 1
4 1 4 6 4 1
5 1 5 10 10 5 1
100

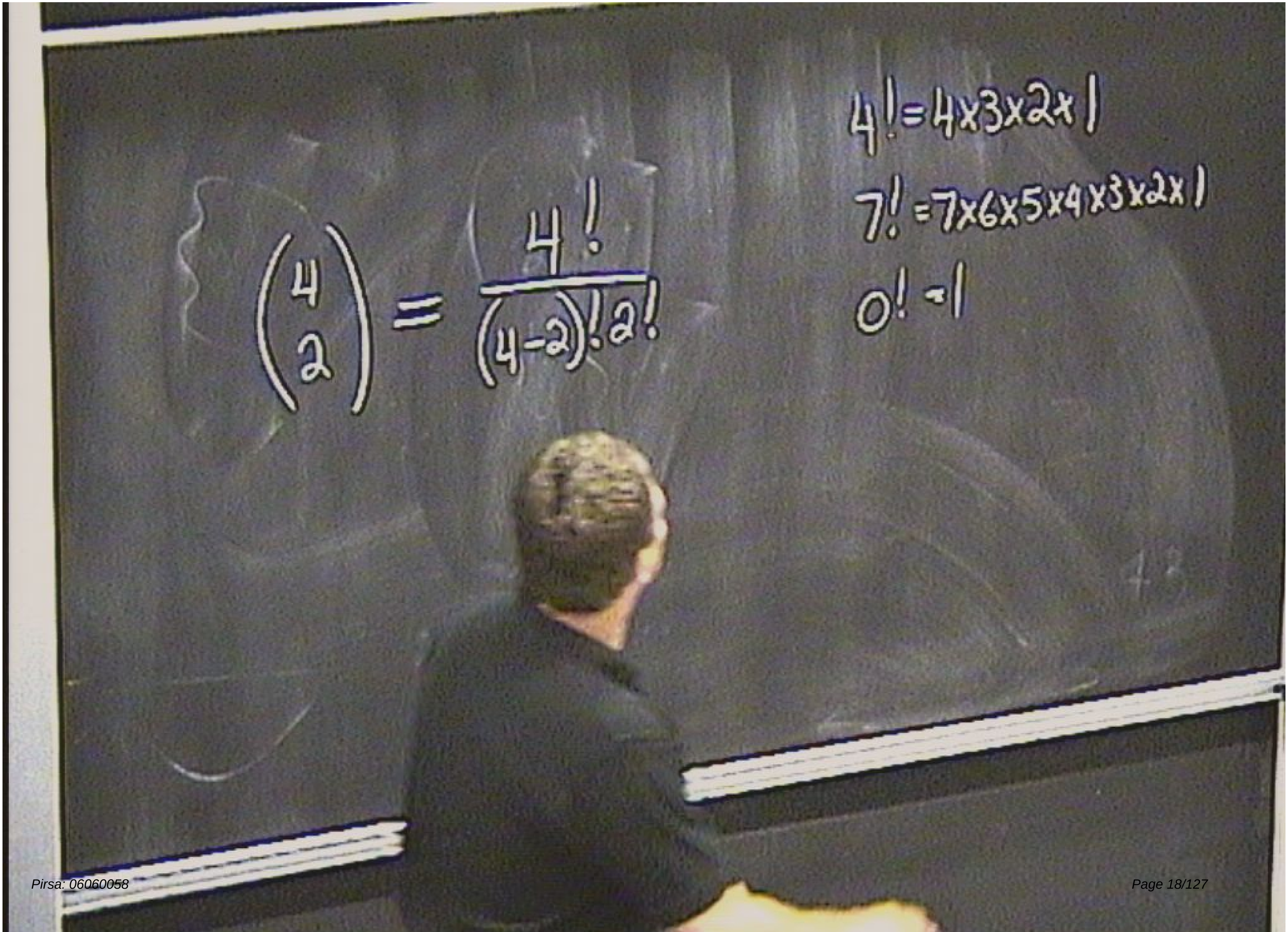

$\binom{4}{2} =$


$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$


$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$
$4! = 4 \times 3 \times 2 \times 1$



$4! = 4 \times 3 \times 2 \times 1$
$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$
$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$


$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$
$4! = 4 \times 3 \times 2 \times 1$
$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$
$0! = 1$

$$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$$

$$4! = 4 \times 3 \times 2 \times 1$$

$$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

$$0! = 1$$

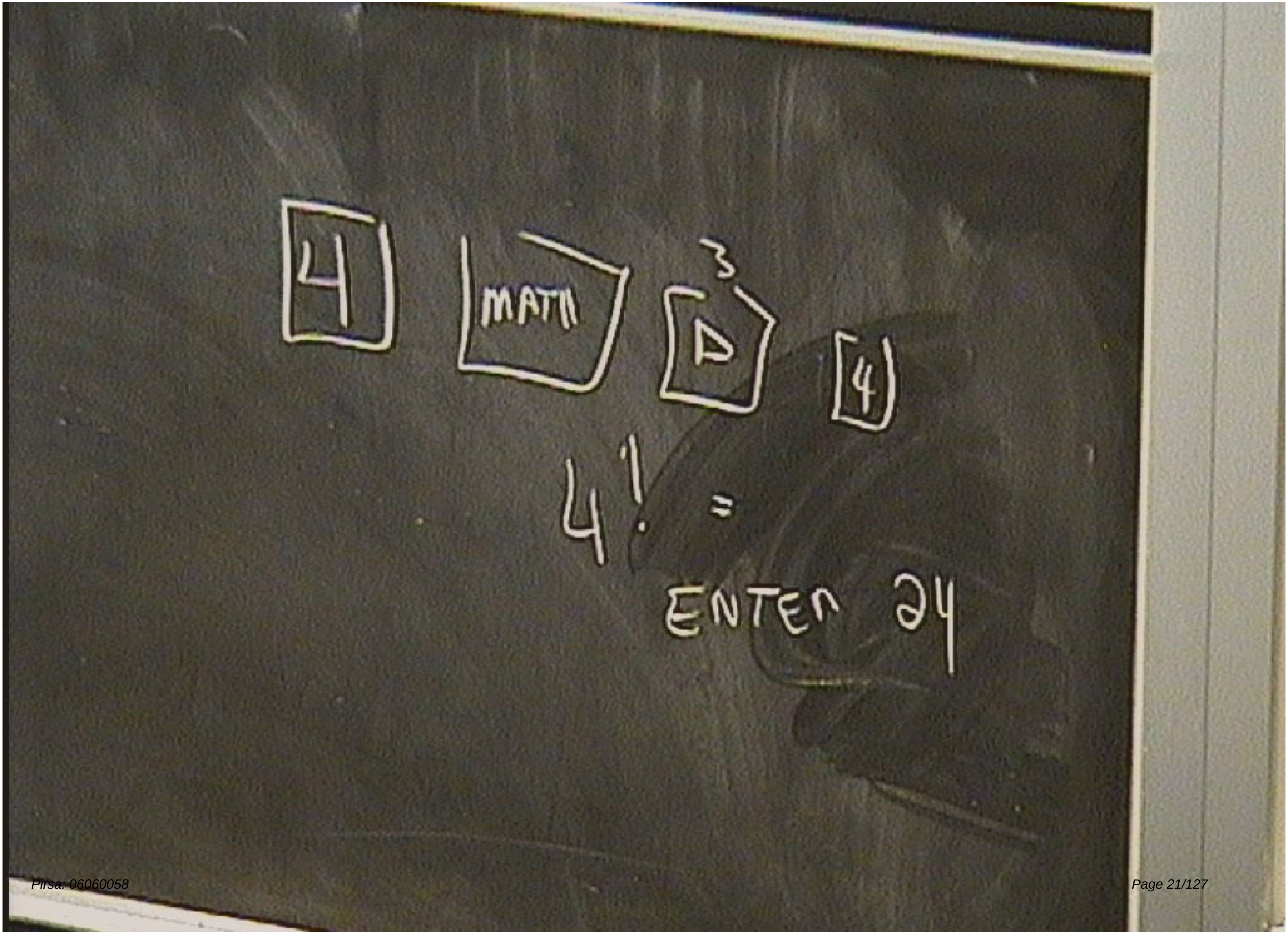
$$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$$

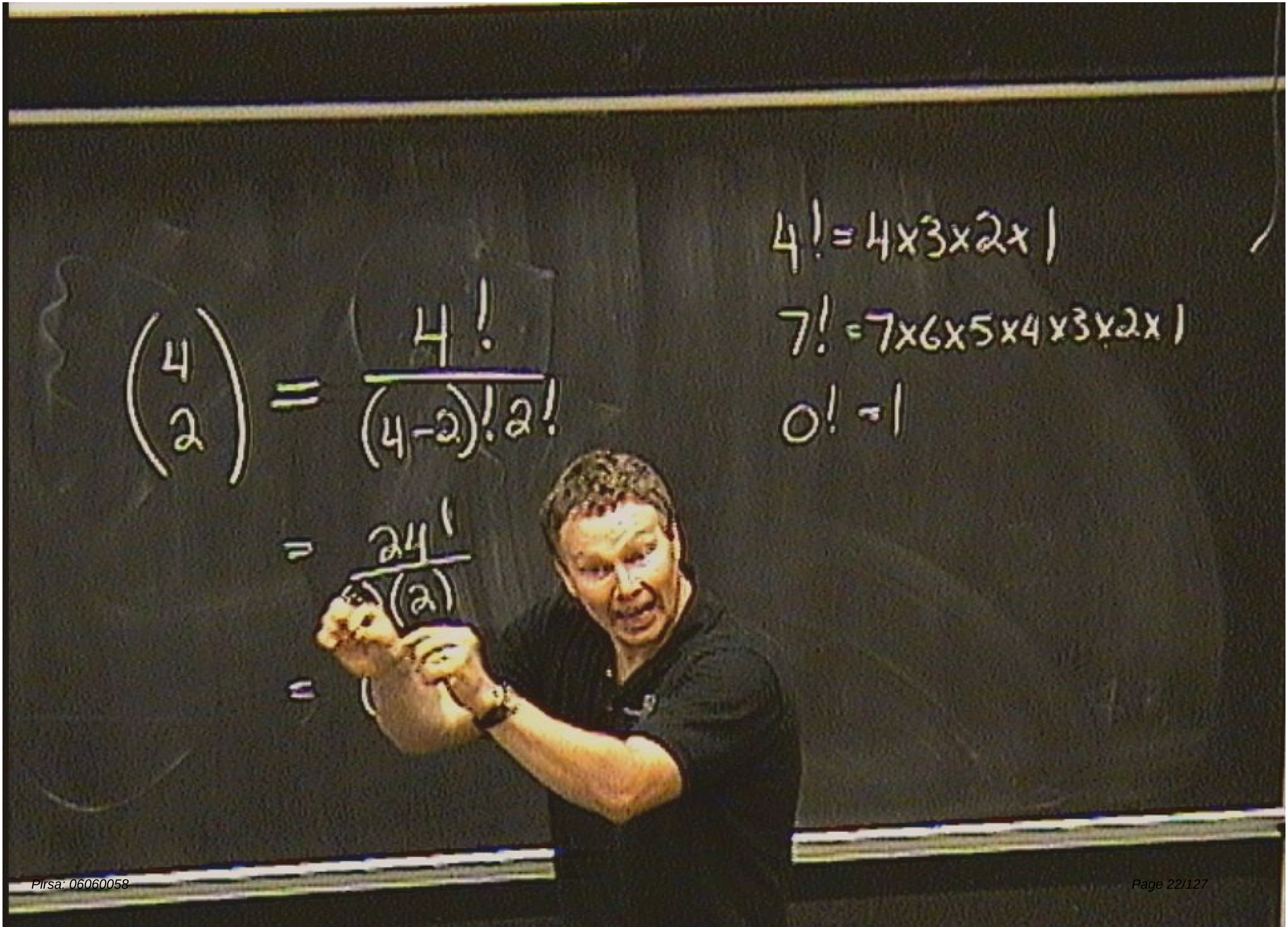
$$= \underline{24}$$

$4! = 4 \times 3 \times 2 \times 1$

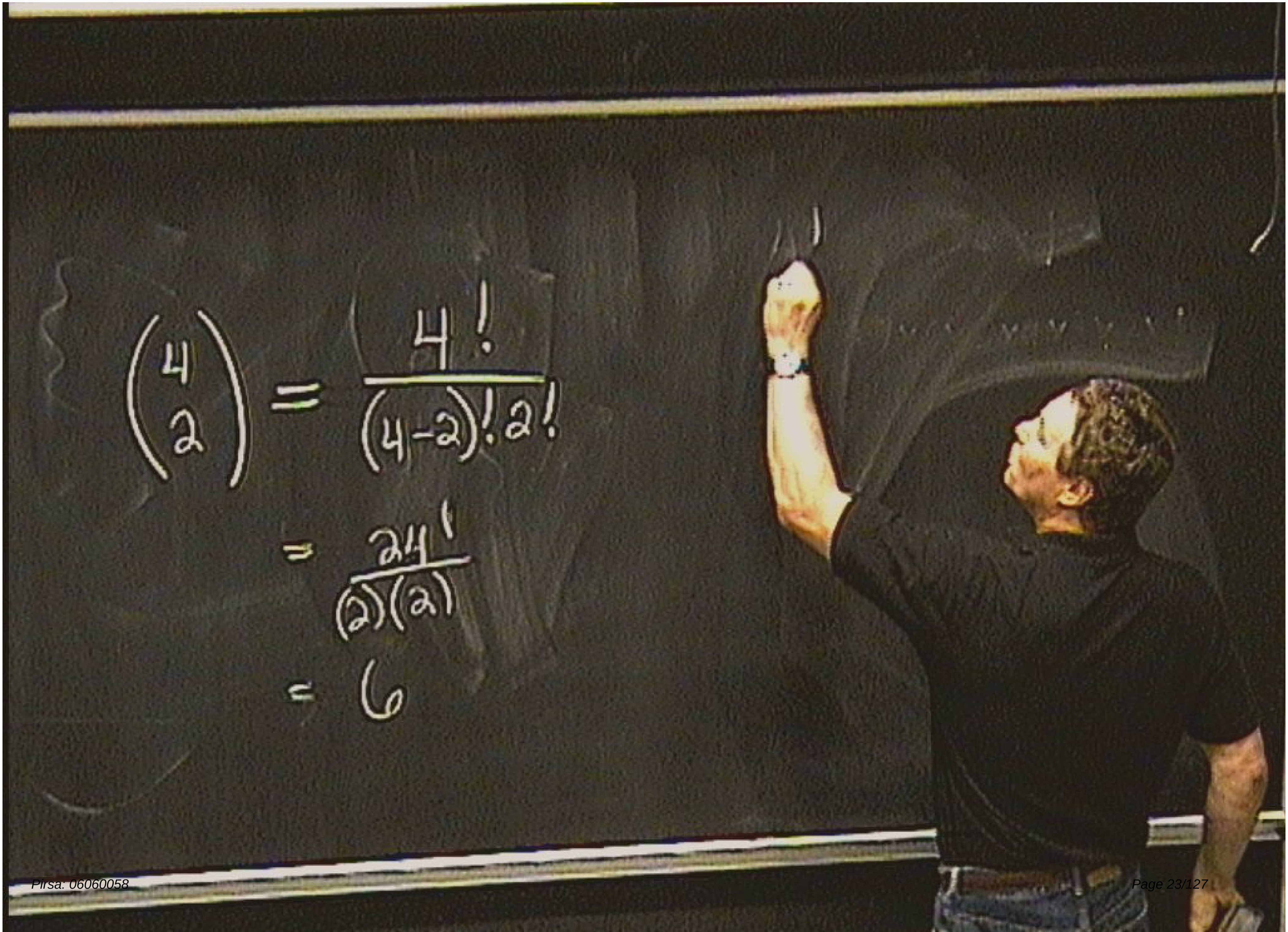
$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times$

$0! = 1$


4
MATH
3
4
4! =
ENTER 24



(4 2) = 4! / (4-2)! 2!
= 24 / (2)
=
4! = 4x3x2x1
7! = 7x6x5x4x3x2x1
0! = 1


$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$
$= \frac{24}{(2)(2)}$
$= 6$

$$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$$

$$= \frac{24}{(2)(2)}$$

$$= 6$$

$$\binom{5}{3} = \frac{5!}{(5-3)!}$$

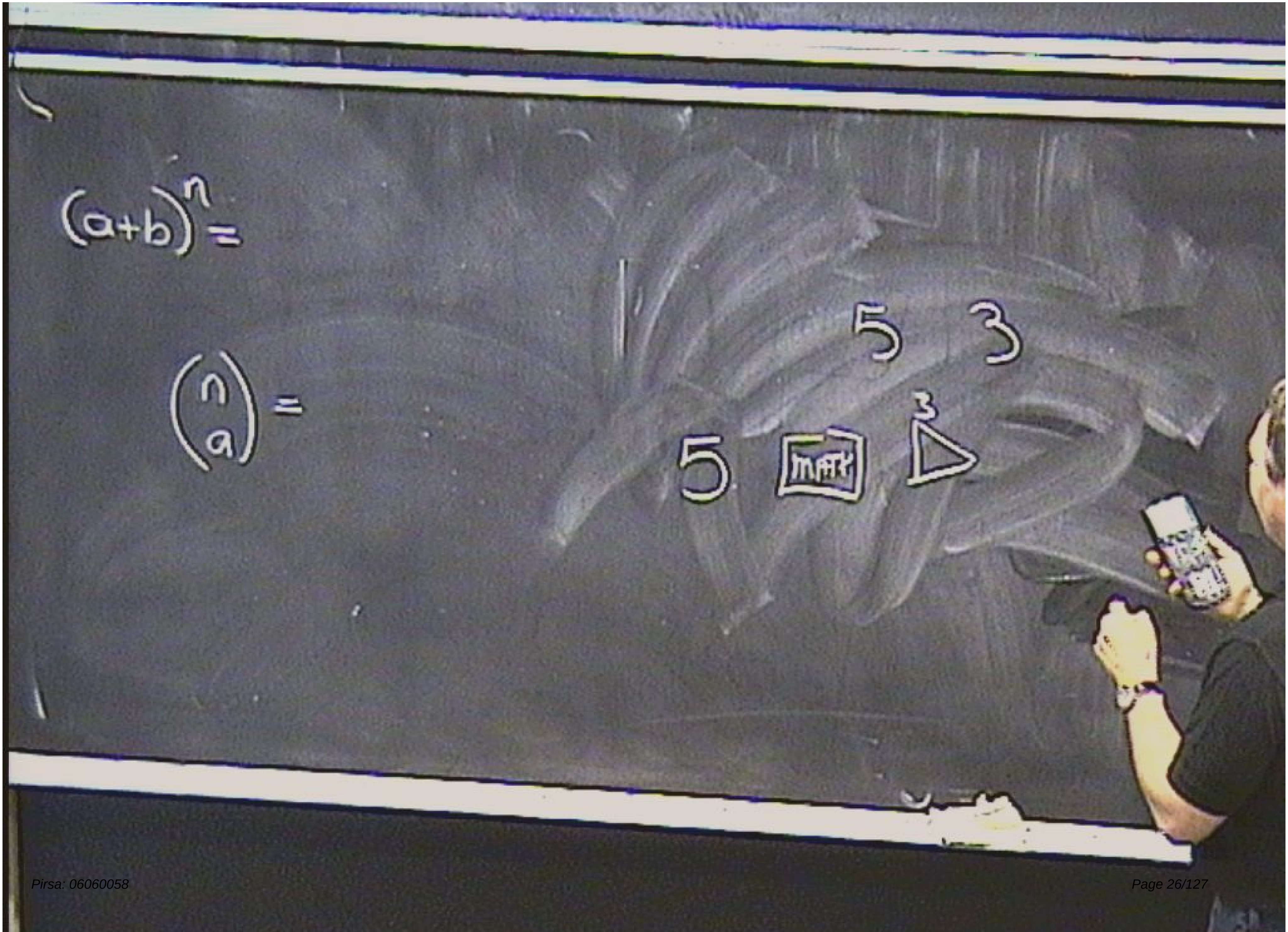
$$\binom{4}{2} = \frac{4!}{(4-2)!\,2!}$$

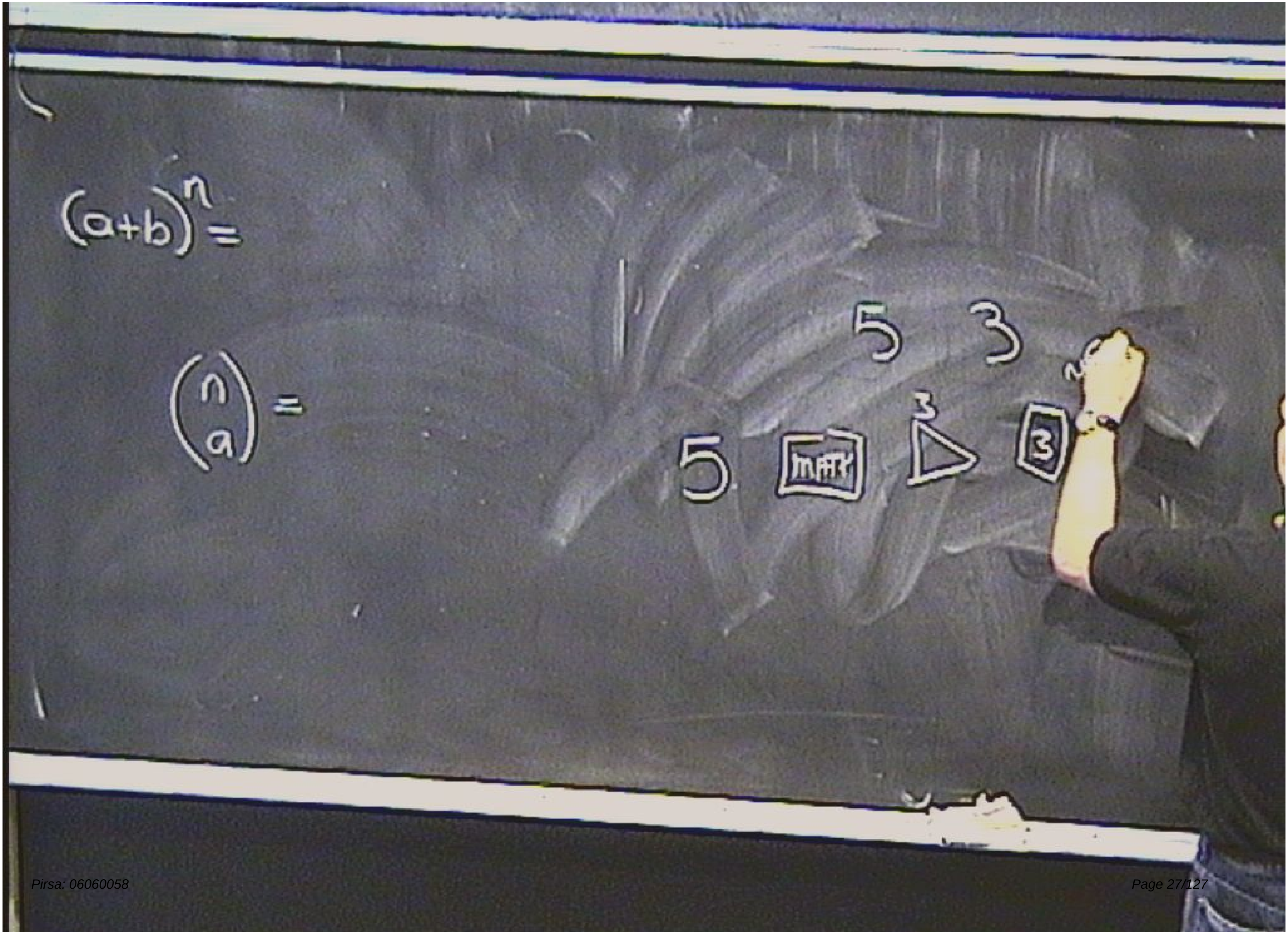
$$= \frac{24}{(2)(2)}$$

$$= 6$$

$$\binom{5}{3} = \frac{5!}{(5-3)!\,3!}$$

$$=$$


(a+b)^n =
(n a) =
5 3
5
3


$(a+b)^n =$
$\binom{n}{a} =$
5 3
5
3

$(a+b)^n =$

$\binom{n}{a} =$

5 3 nCr

5 $\boxed{3}$ $\boxed{3}$

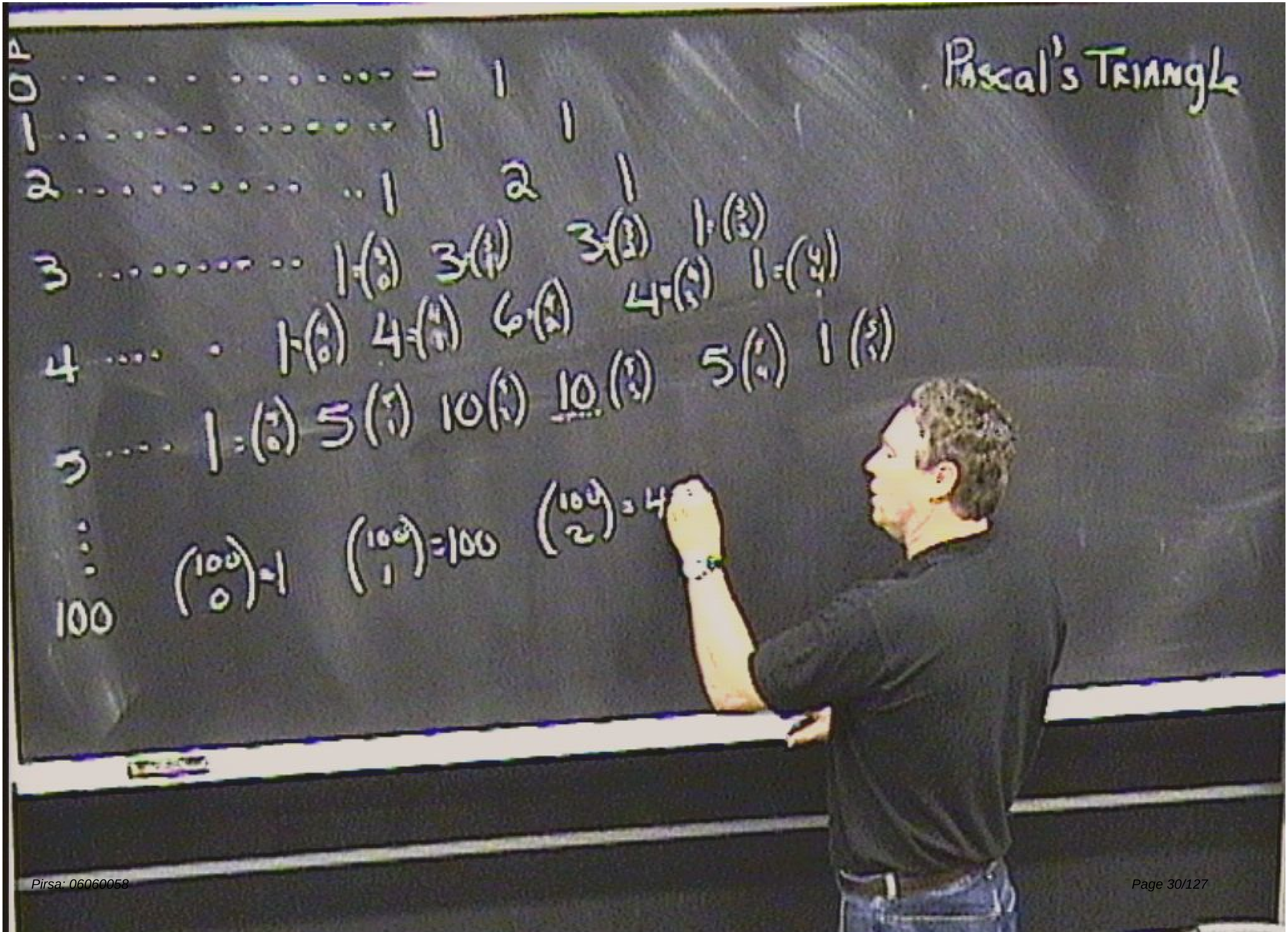
$(a+b)^n =$

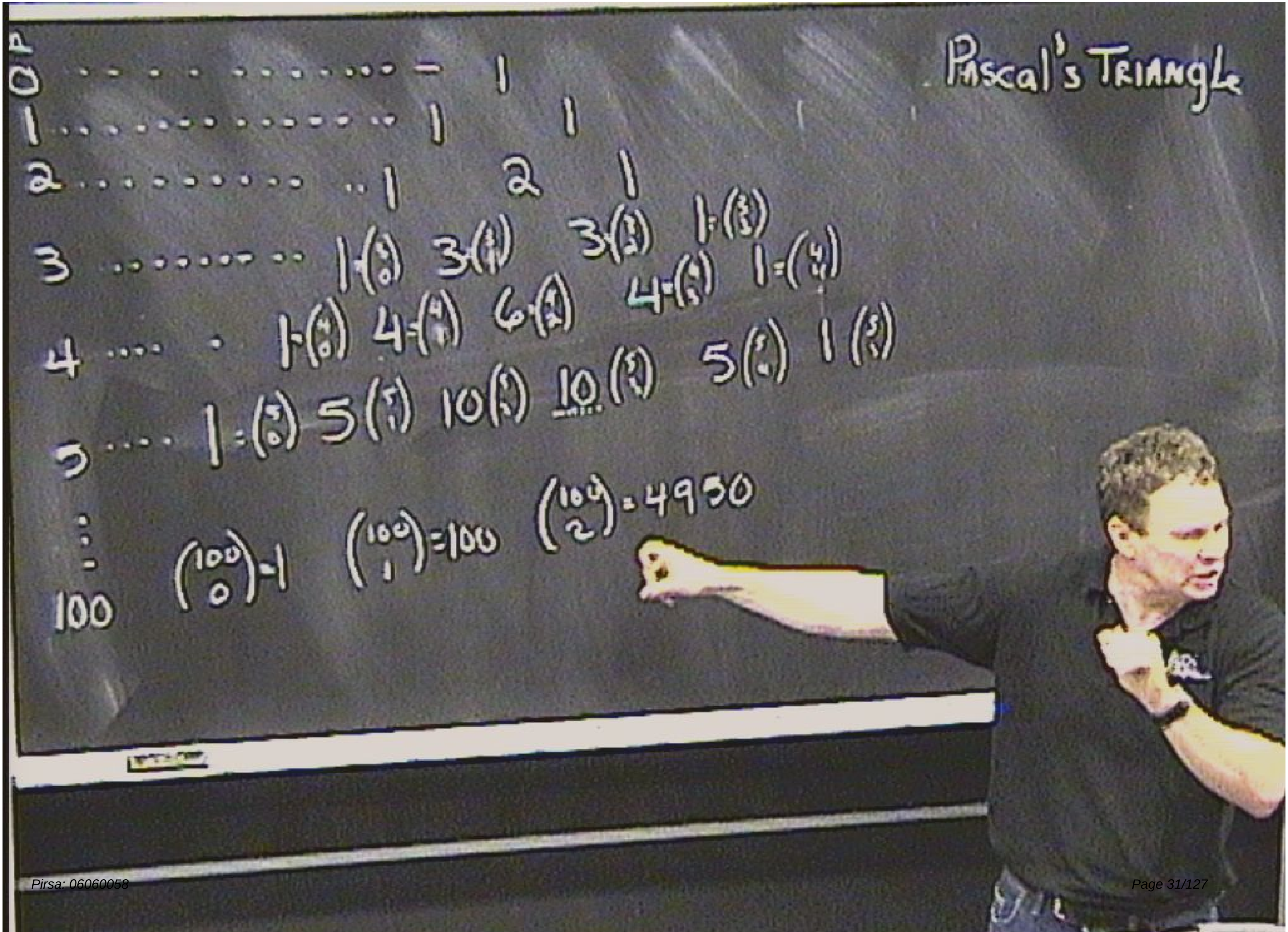
$\binom{n}{a} =$

5 nCr 3 $\boxed{=}$ = 10

5 3 nCr

5 $\boxed{\text{MATH}}$ $\triangleright^{3}$ $\boxed{3}$ $\boxed{3}$


Pascal's Triangle
0 1
1 1 1
2 1 2 1
3 1 3 3 1
4 1 4 6 4 1
5 1 5 10 10 5 1
100
(100 0)=1 (100 1)=100 (100 2)=4


Pascal's Triangle
0 1
1 1 1
2 1 2 1
3 1 3 3 1
4 1 4 6 4 1
5 1 5 10 10 5 1
100
(100 0)=1
(100 1)=100
(100 2)=4950

Pascal's Triangle

0 1

1 .... 1 1

2 .... 1 2 1

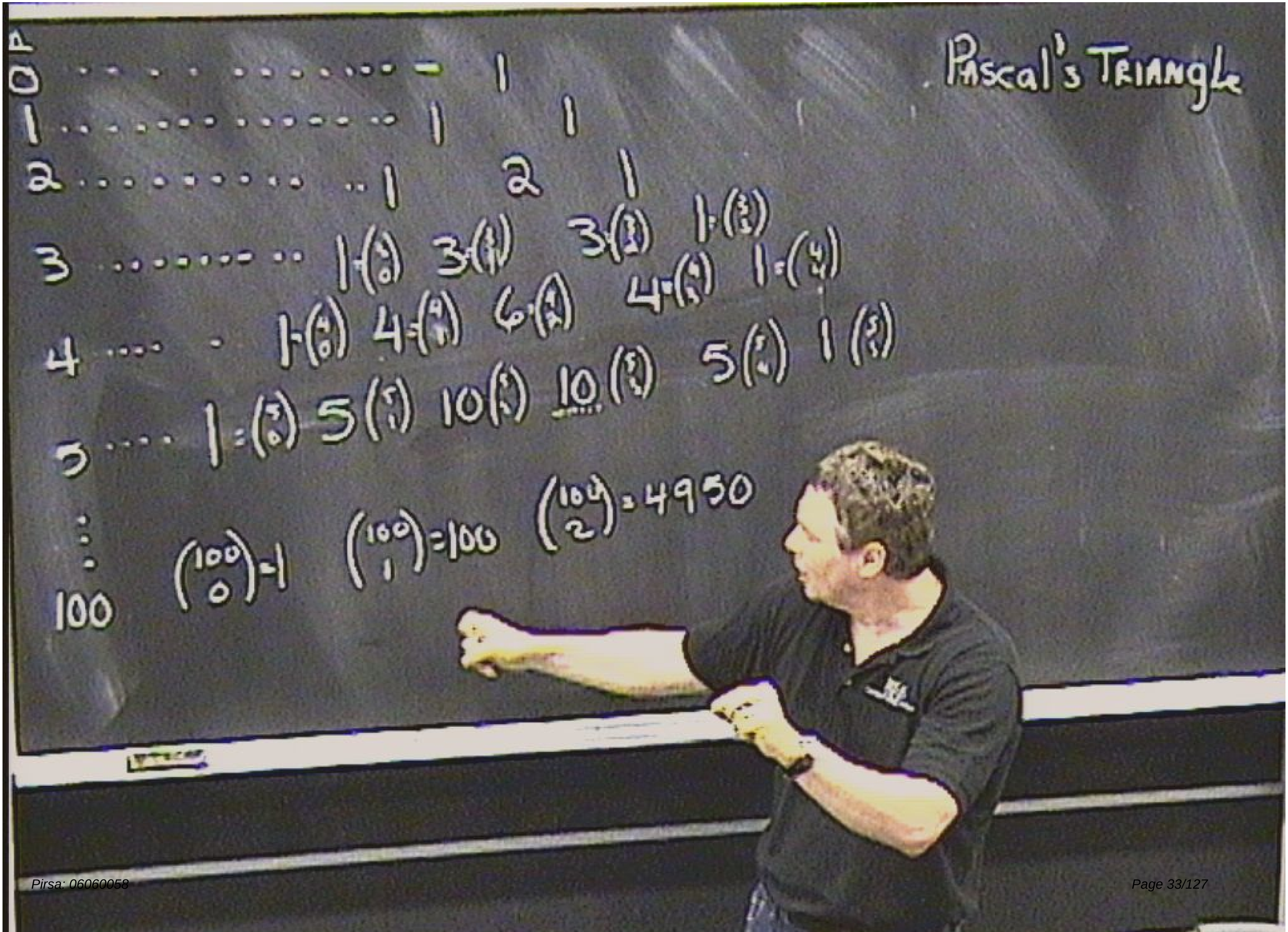
3 .... $1=\binom{3}{0}$ $3=\binom{3}{1}$ $3=\binom{3}{2}$ $1=\binom{3}{3}$

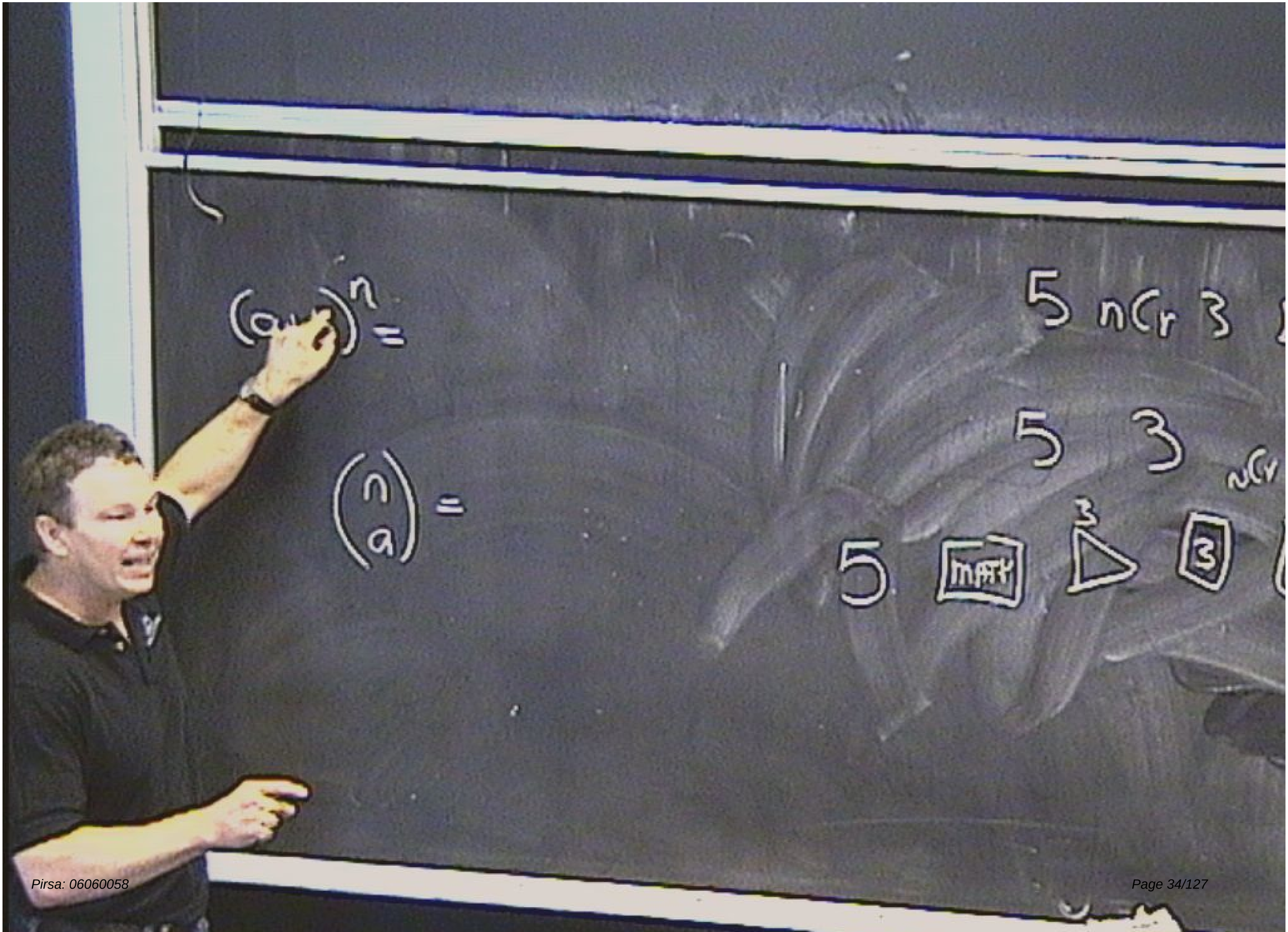
4 .... $1=\binom{4}{0}$ $4=\binom{4}{1}$ $6=\binom{4}{2}$ $4=\binom{4}{3}$ $1=\binom{4}{4}$

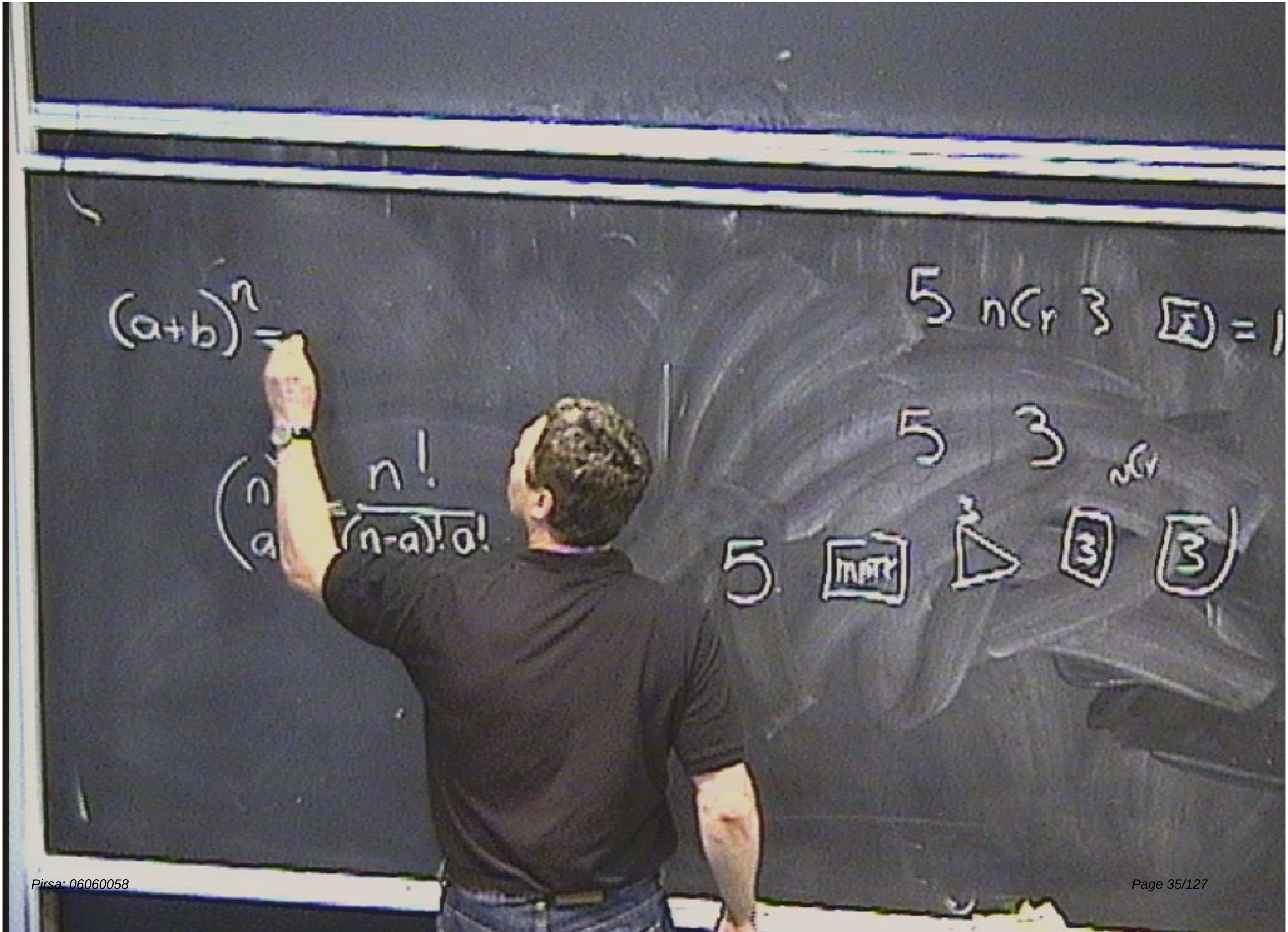
5 .... $1=\binom{5}{0}$ $5\binom{5}{1}$ $10\binom{5}{2}$ $10\binom{5}{3}$ $5\binom{5}{4}$ $1\binom{5}{5}$

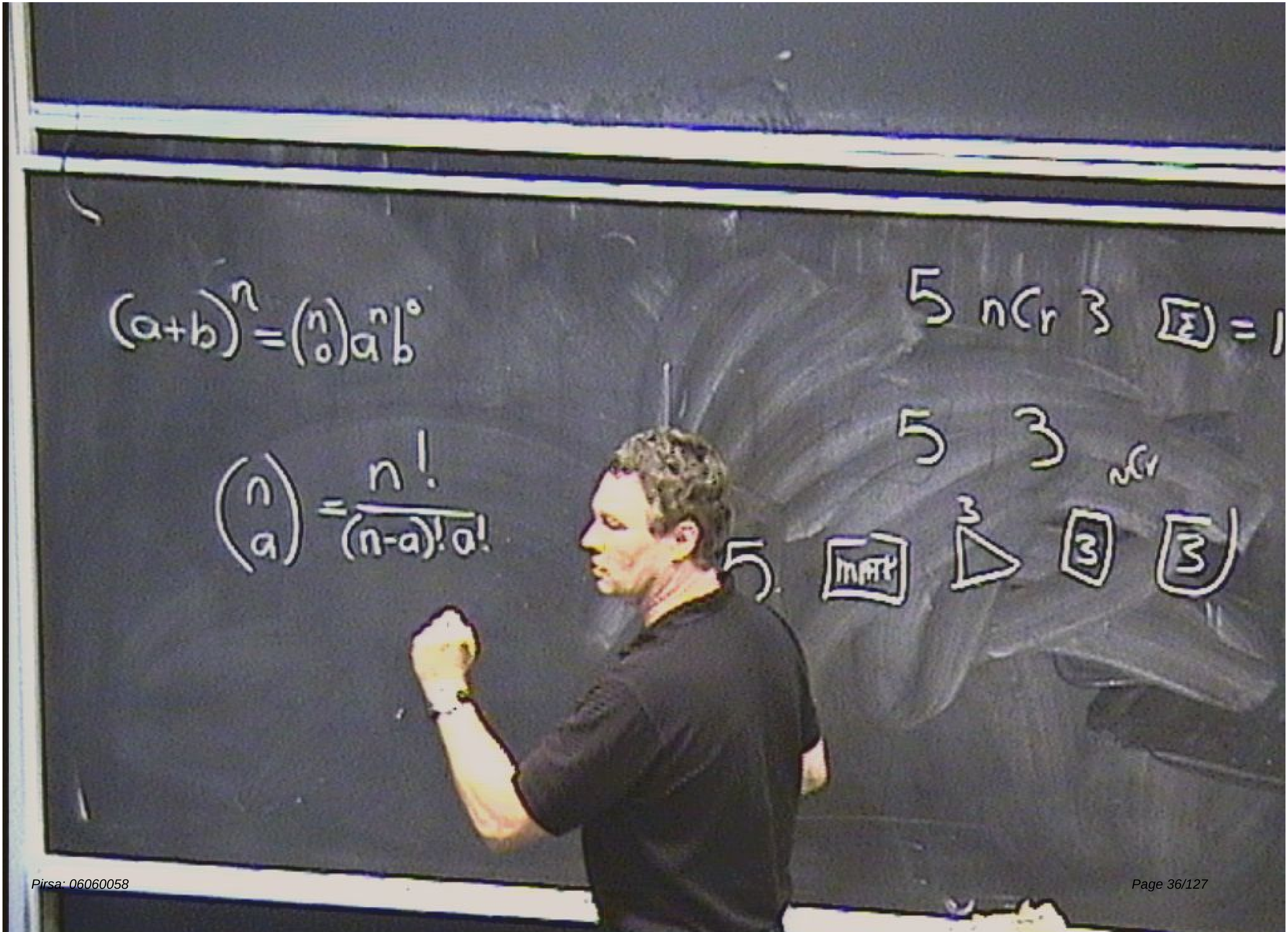
⋮

100 $\binom{100}{0}=1$ $\binom{100}{1}=100$ $\binom{100}{2}=4950$

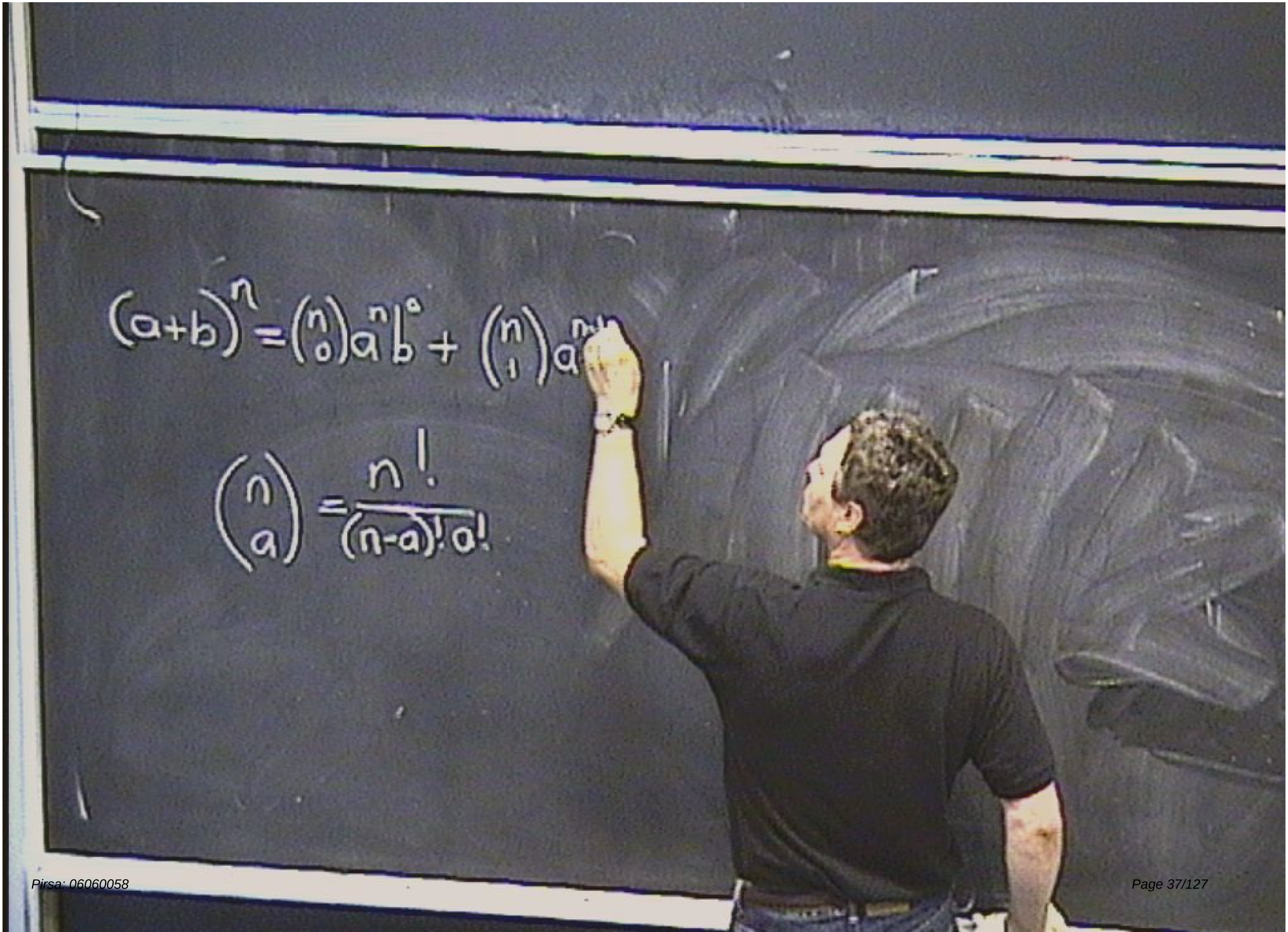

Pascal's Triangle
0 1
1 1 1
2 1 2 1
3 $1 = \binom{3}{0}$ $3 = \binom{3}{1}$ $3 = \binom{3}{2}$ $1 = \binom{3}{3}$
4 $1 = \binom{4}{0}$ $4 = \binom{4}{1}$ $6 = \binom{4}{2}$ $4 = \binom{4}{3}$ $1 = \binom{4}{4}$
5 $1 = \binom{5}{0}$ $5 \binom{5}{1}$ $10 \binom{5}{2}$ $10 \binom{5}{3}$ $5 \binom{5}{4}$ $1 \binom{5}{5}$
100 $\binom{100}{0} = 1$ $\binom{100}{1} = 100$ $\binom{100}{2} = 4950$

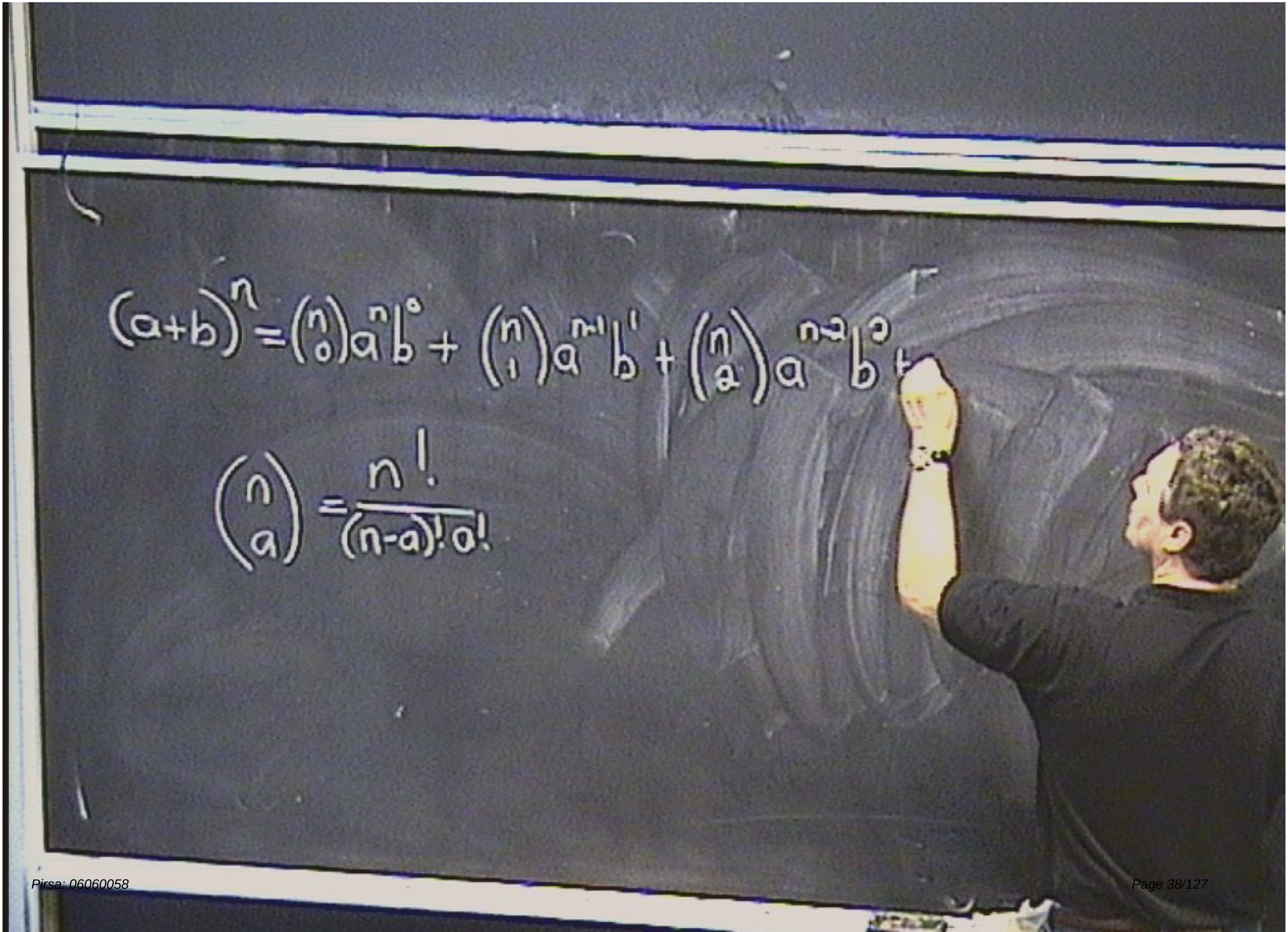

5 nCr 3
5 3
nCr
5
3


(a+b)^n =
n!
(n-a)! a!
5 nCr 3
5 3
nCr
5



$(a+b)^n = \binom{n}{0} a^n b^0$
$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$
5 nCr 3
5 3


$(a+b)^n=\binom{n}{0}a^nb^0+\binom{n}{1}a$
$\binom{n}{a}=\frac{n!}{(n-a)!\,a!}$

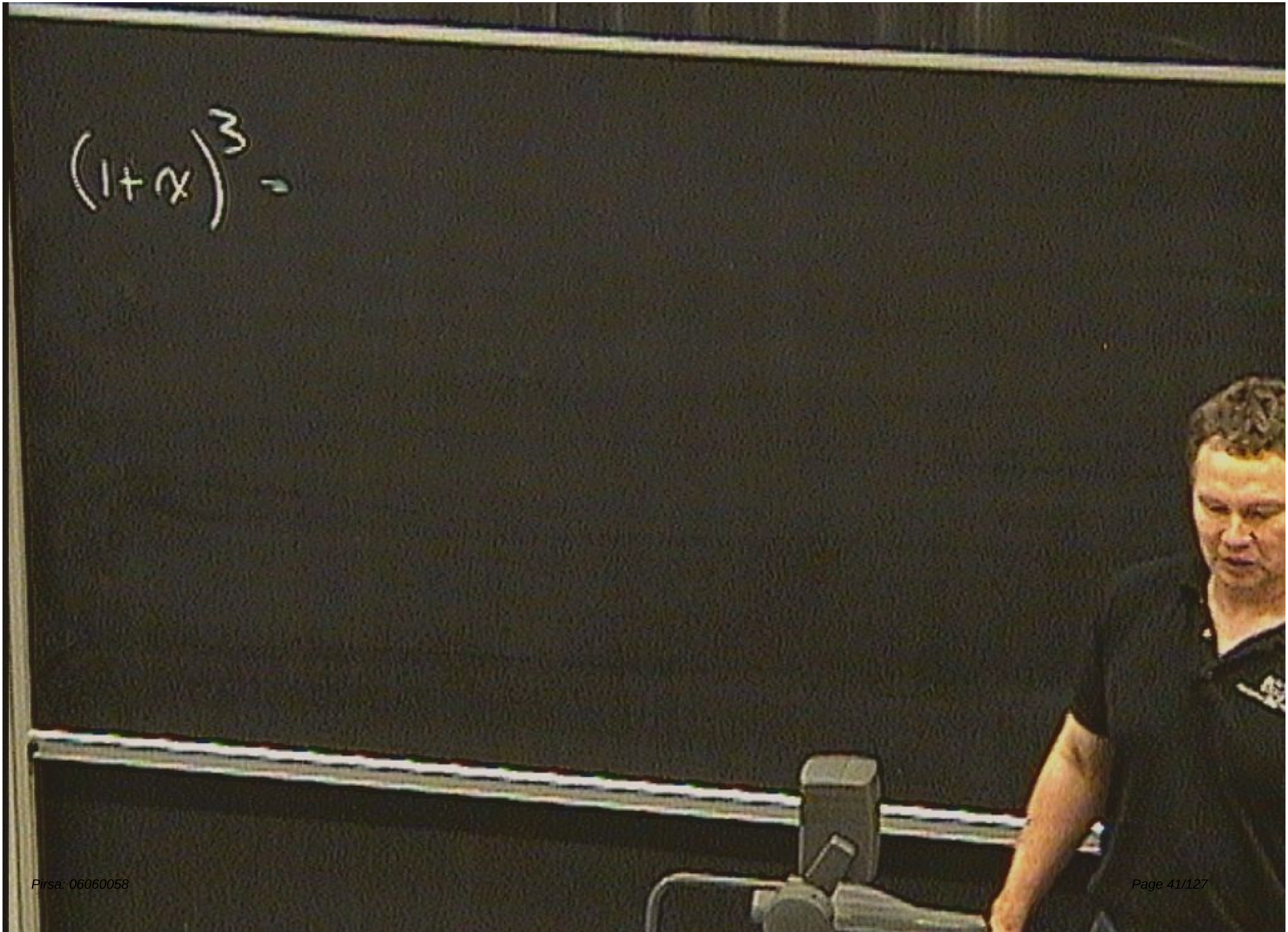

$(a+b)^n = \binom{n}{0}a^n b^0 + \binom{n}{1}a^{n-1}b^1 + \binom{n}{2}a^{n-2}b^2 +$
$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$

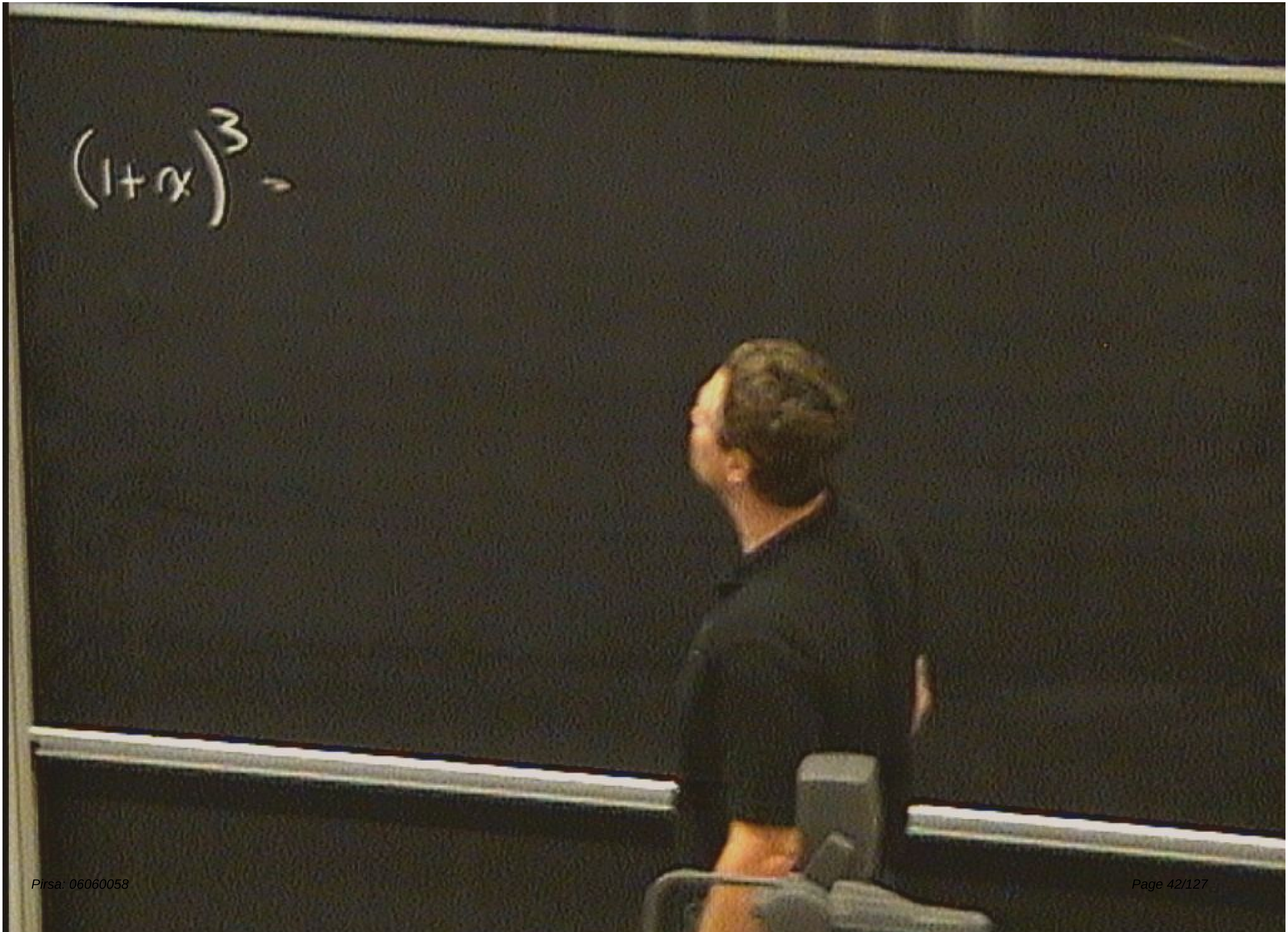
$$(a+b)^n = \binom{n}{0} a^n b^0 + \binom{n}{1} a^{n-1} b^1 + \binom{n}{2} a^{n-2} b^2 + \cdots + \binom{n}{r} a$$

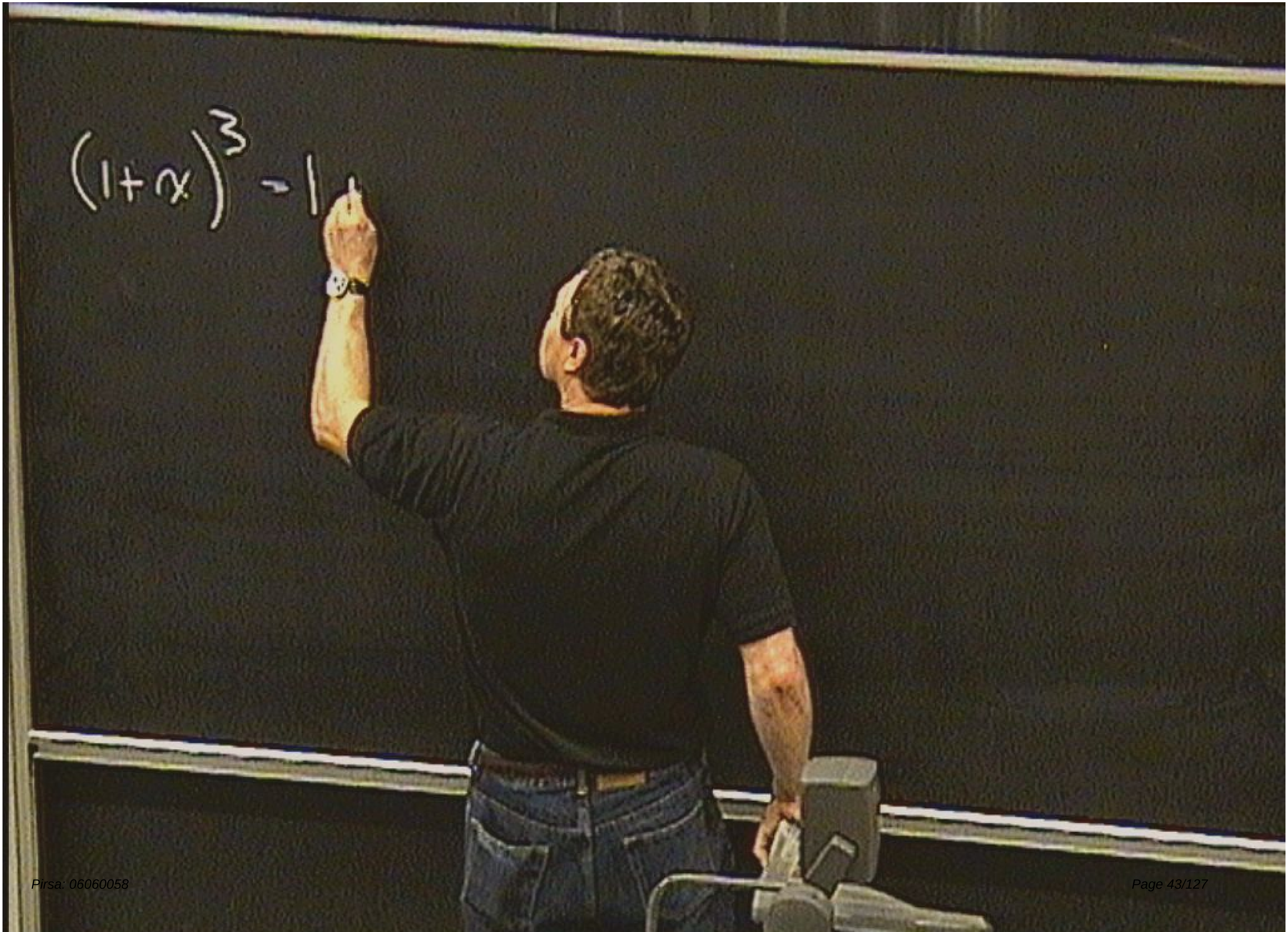
$$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$$

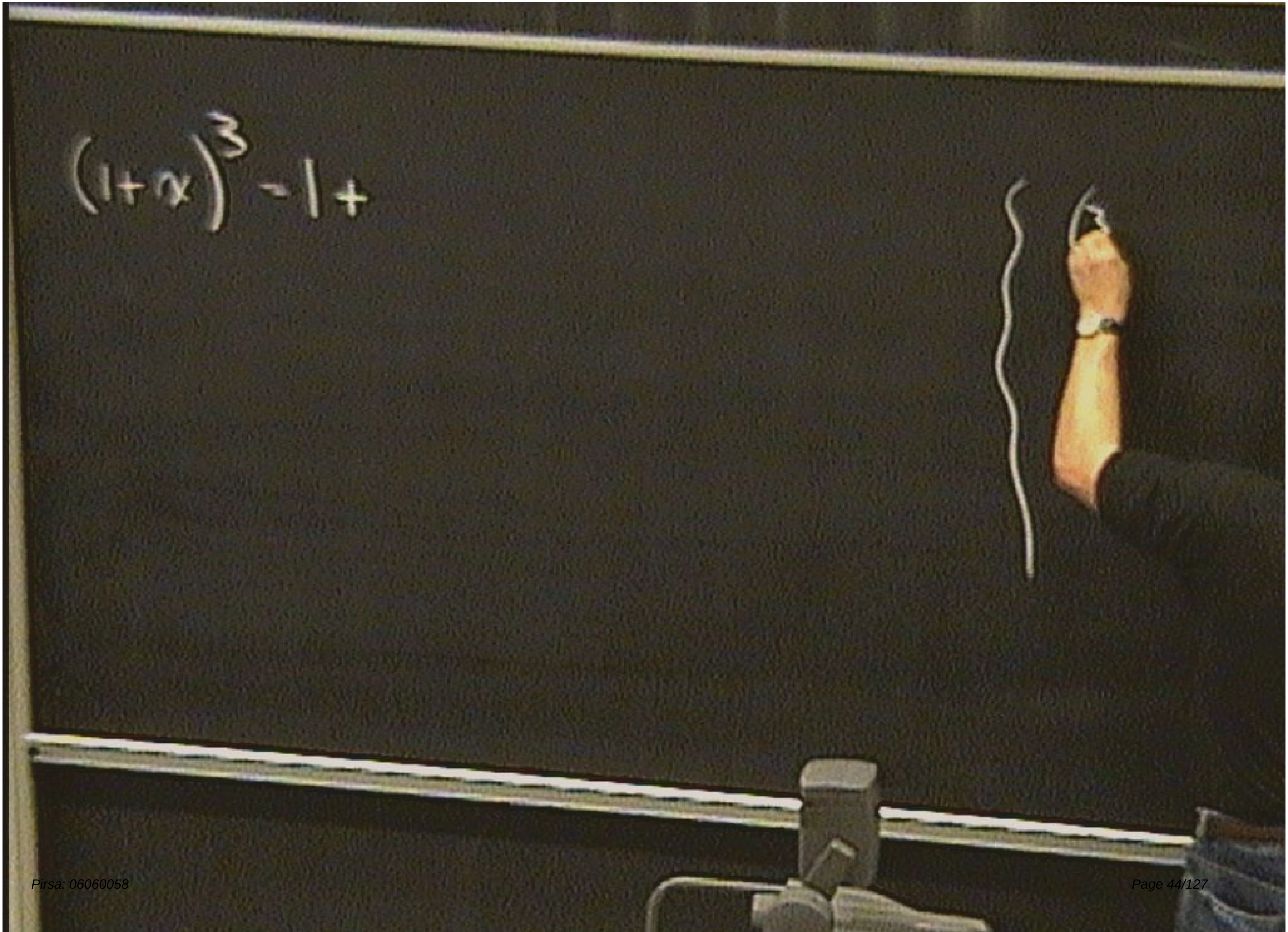
$$(a+b)^n = \binom{n}{0} a^n b^0 + \binom{n}{1} a^{n-1} b^1 + \binom{n}{2} a^{n-2} b^2 + \cdots + \binom{n}{r} a^{n-r} b^r + \cdots$$

$$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$$


$(1+x)^3 =$


$(1+x)^3 =$


$(1+x)^3 - 1$

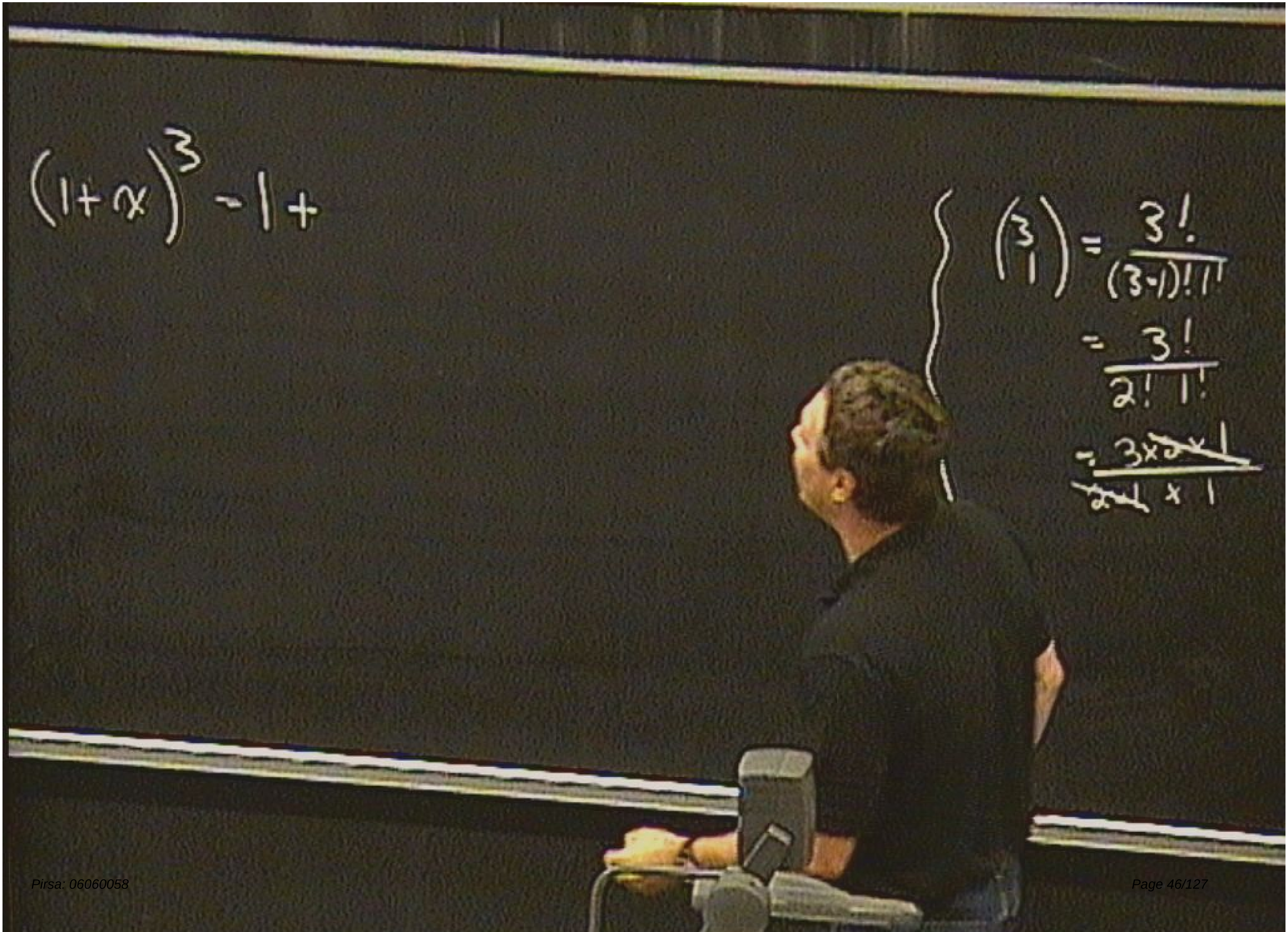

$(1+x)^3 = 1 +$

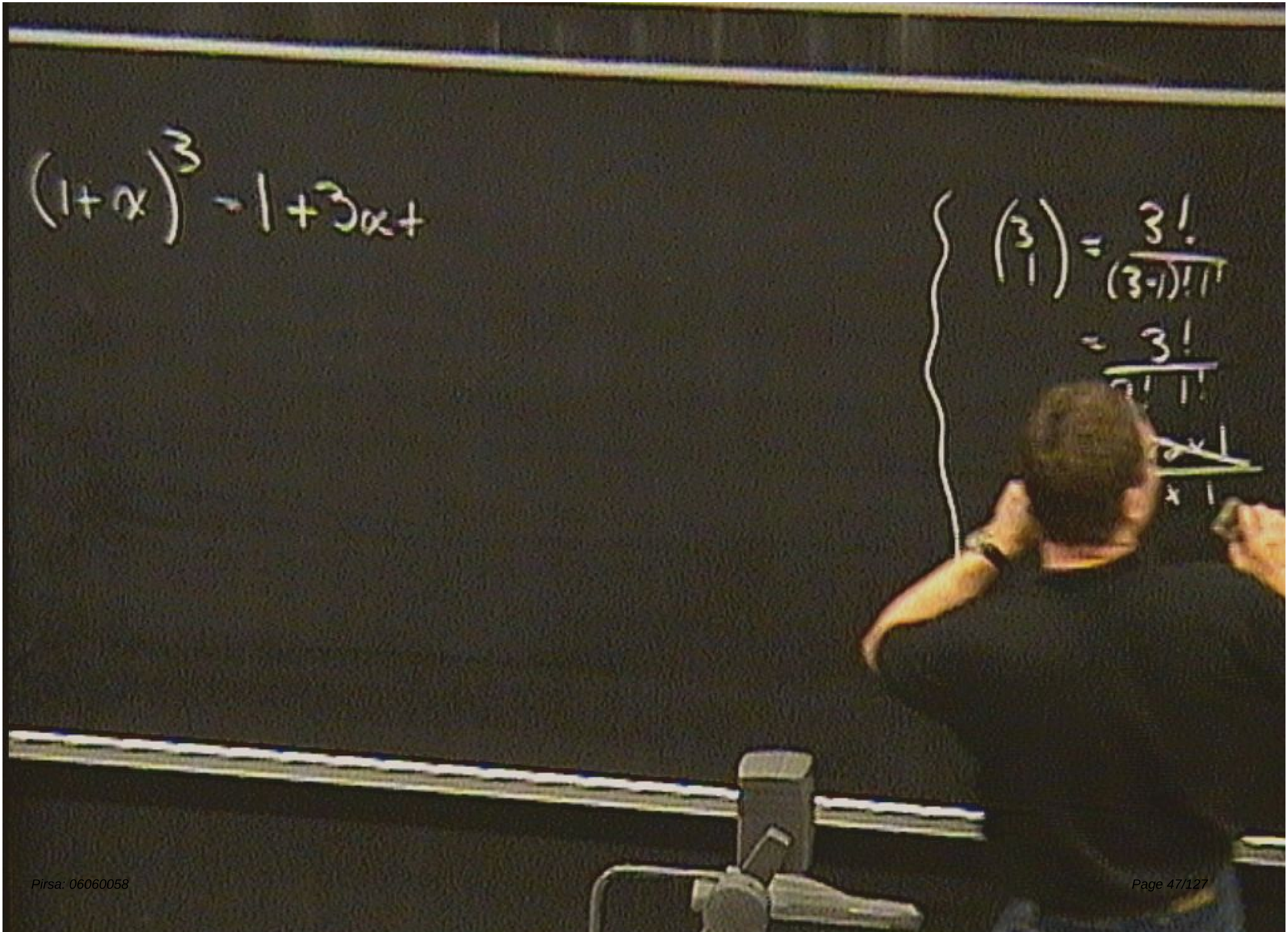
$$(1+x)^3 = 1 +$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$$

$$= \frac{3!}{2!\,1!}$$

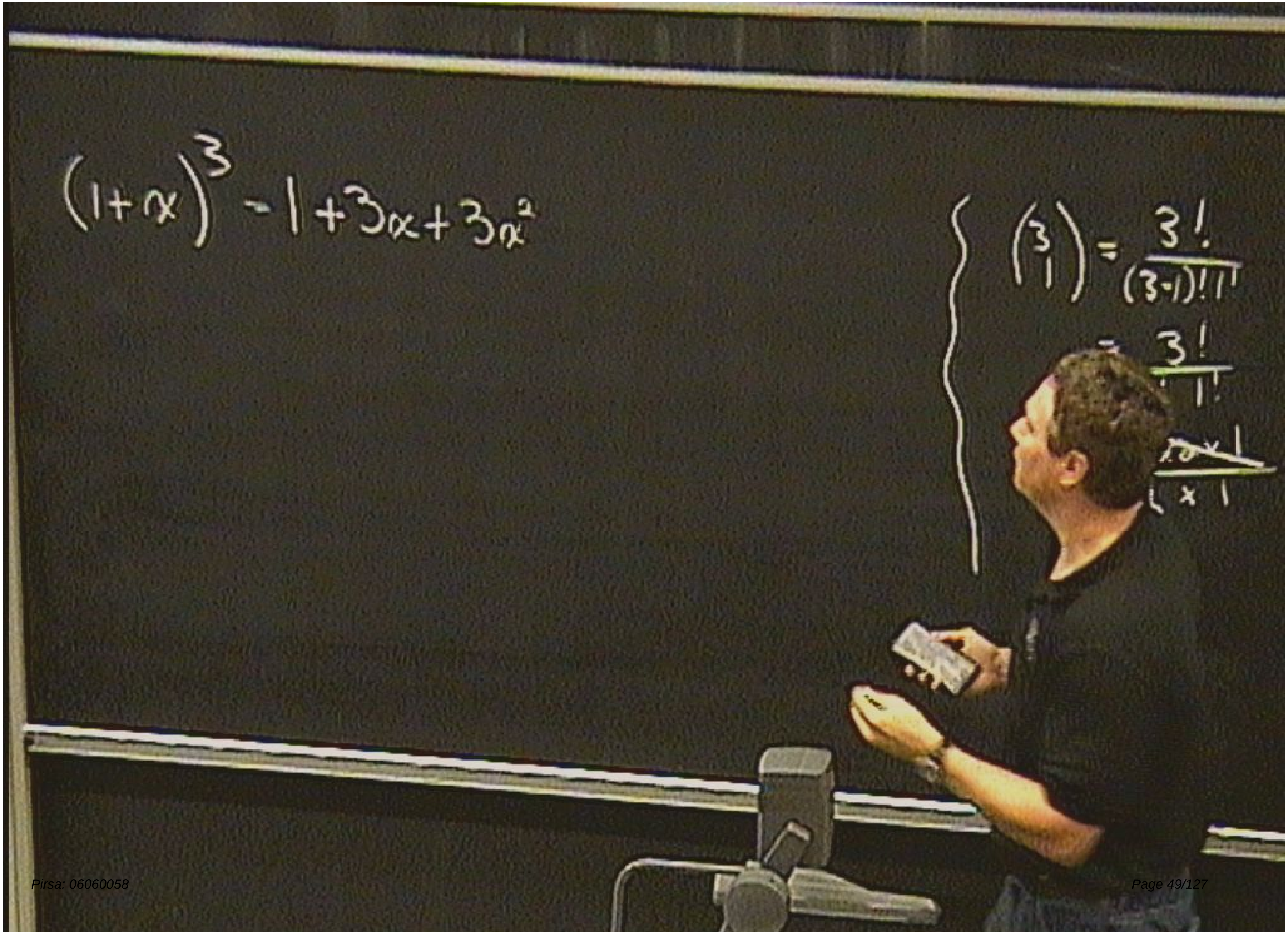
$$=$$


$(1+x)^3 = 1 +$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$
$= \frac{3 \times \cancel{2 \times 1}}{\cancel{2 \times 1} \times 1}$


$(1+x)^3 = 1 + 3x +$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$

$$(1+x)^3 = 1 + 3x + $$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3\times\cancel{2\times1}}{\cancel{2\times1}\times 1}$$



$(1+x)^3 = 1 + 3x + 3x^2$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$

$$(1+x)^3 = 1 + 3x + 3x^2 + 1x^3$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3 \times \cancel{2 \times 1}}{\cancel{2 \times 1} \times 1}$$

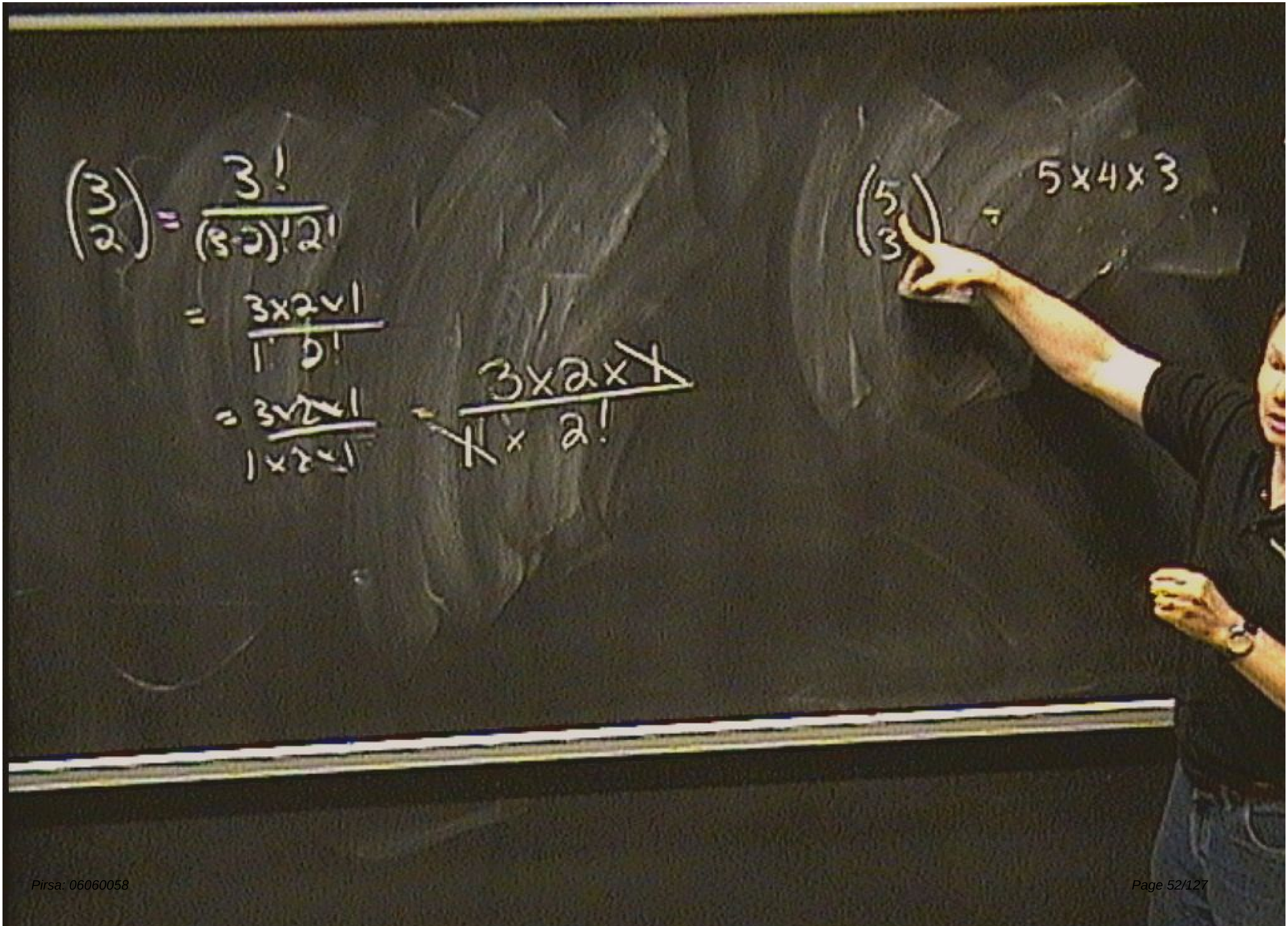
$$\binom{3}{2} = \frac{3!}{(3-2)!\,2!}$$

$$= \frac{3\times2\times1}{1!\,2!}$$

$$= \frac{3\times\cancel{2\times1}}{1\times2\times1} = \frac{3\times2\times\cancel{1}}{\cancel{1}\times 2!}$$

$$\binom{5}{3} = \frac{5!}{(5-3)!\,3!}$$

$$=$$

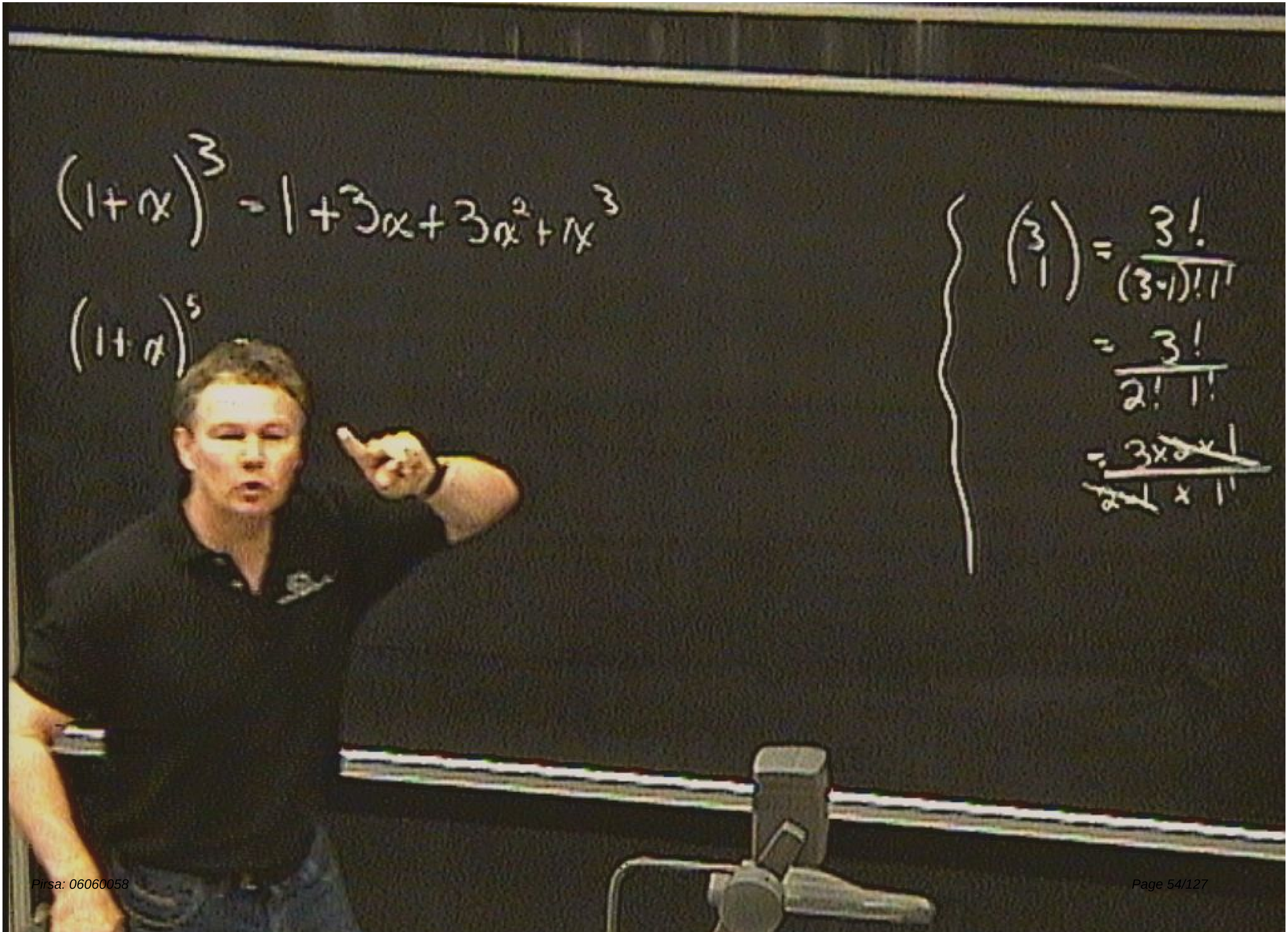

(3 2) = 3! / (3-2)! 2!
= 3×2×1 / 1! 2!
= 3×2×1 / 1×2×1
3×2×1 / 1×2!
(5 3) = 5×4×3

$$\binom{3}{2} = \frac{3!}{(3-2)!\,2!}$$

$$= \frac{3\times2\times1}{1!\;2!}$$

$$= \frac{3\times2\times1}{1\times2\times1} = \frac{3\times2\times\cancel{1}}{\cancel{1}\times 2!}$$

$$\binom{5}{3} = \frac{5\times4\times3}{3!}$$


$(1+x)^3 = 1 + 3x + 3x^2 + x^3$
$(1+x)^5$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$

$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

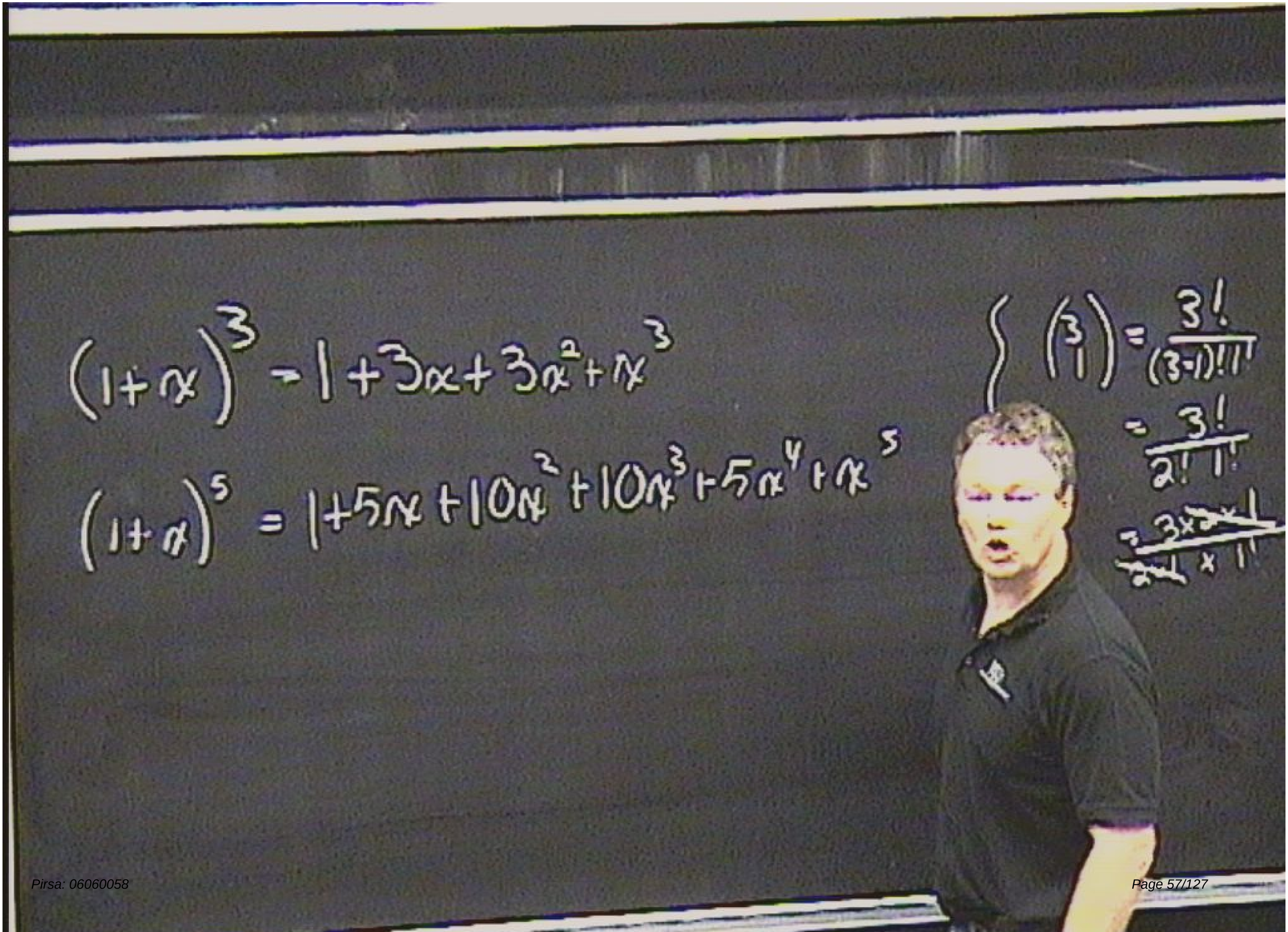
$$(1+x)^5 =$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3 \times \cancel{2 \times 1}}{\cancel{2 \times 1} \times 1}$$

$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

$$(1+x)^5 = 1$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\;1!} = \frac{3\times\cancel{2\times1}}{\cancel{2\times1}\times 1}$$


$(1+x)^3 = 1+3x+3x^2+x^3$
$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$
$= \frac{3\times 2\times 1}{2\times 1\times 1!}$

$$(1+x)^3 = 1+3x+3x^2+x^3$$

$$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3\times\cancel{2\times1}}{\cancel{2\times1}\times 1!}$$

$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

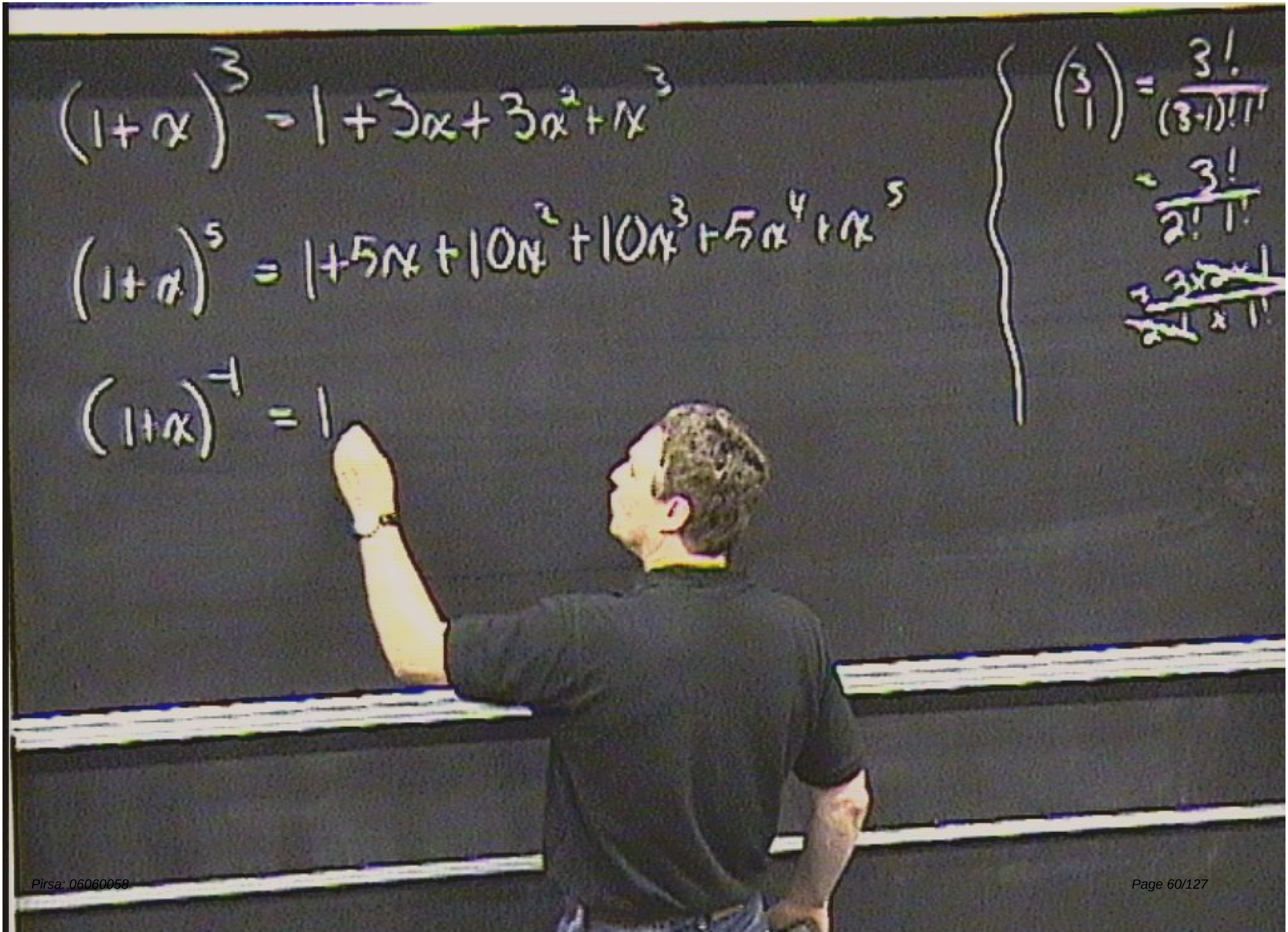
$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

$$(1+x)^7$$

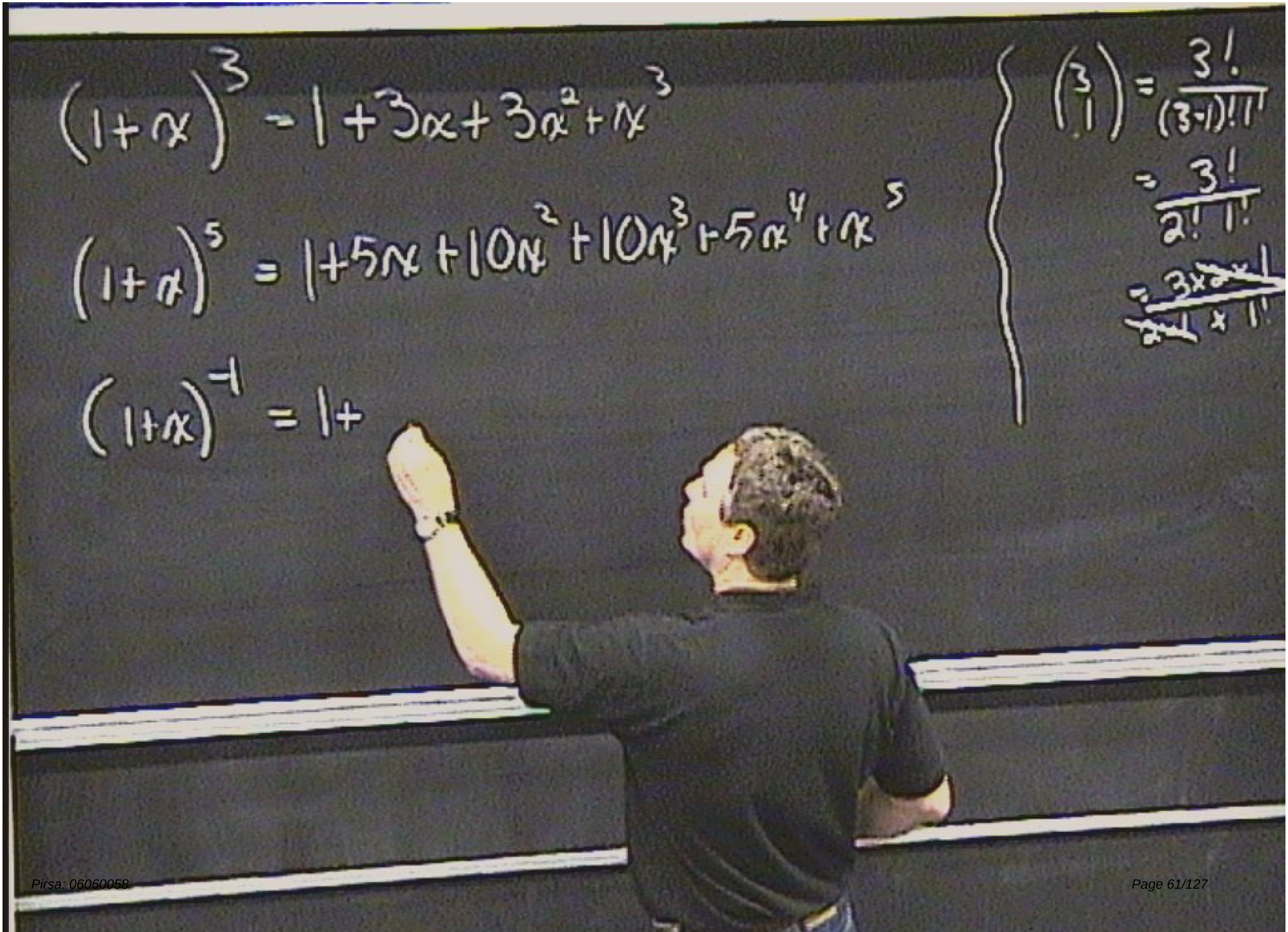
$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$$

$$= \frac{3!}{2!\,1!}$$

$$= \frac{3 \times \cancel{2 \times 1}}{\cancel{2 \times 1} \times 1!}$$



$(1+x)^3 = 1 + 3x + 3x^2 + x^3$
$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$
$(1+x)^{-1} = 1$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$
$= \frac{3 \times 2 \times 1}{2 \times 1 \times 1!}$

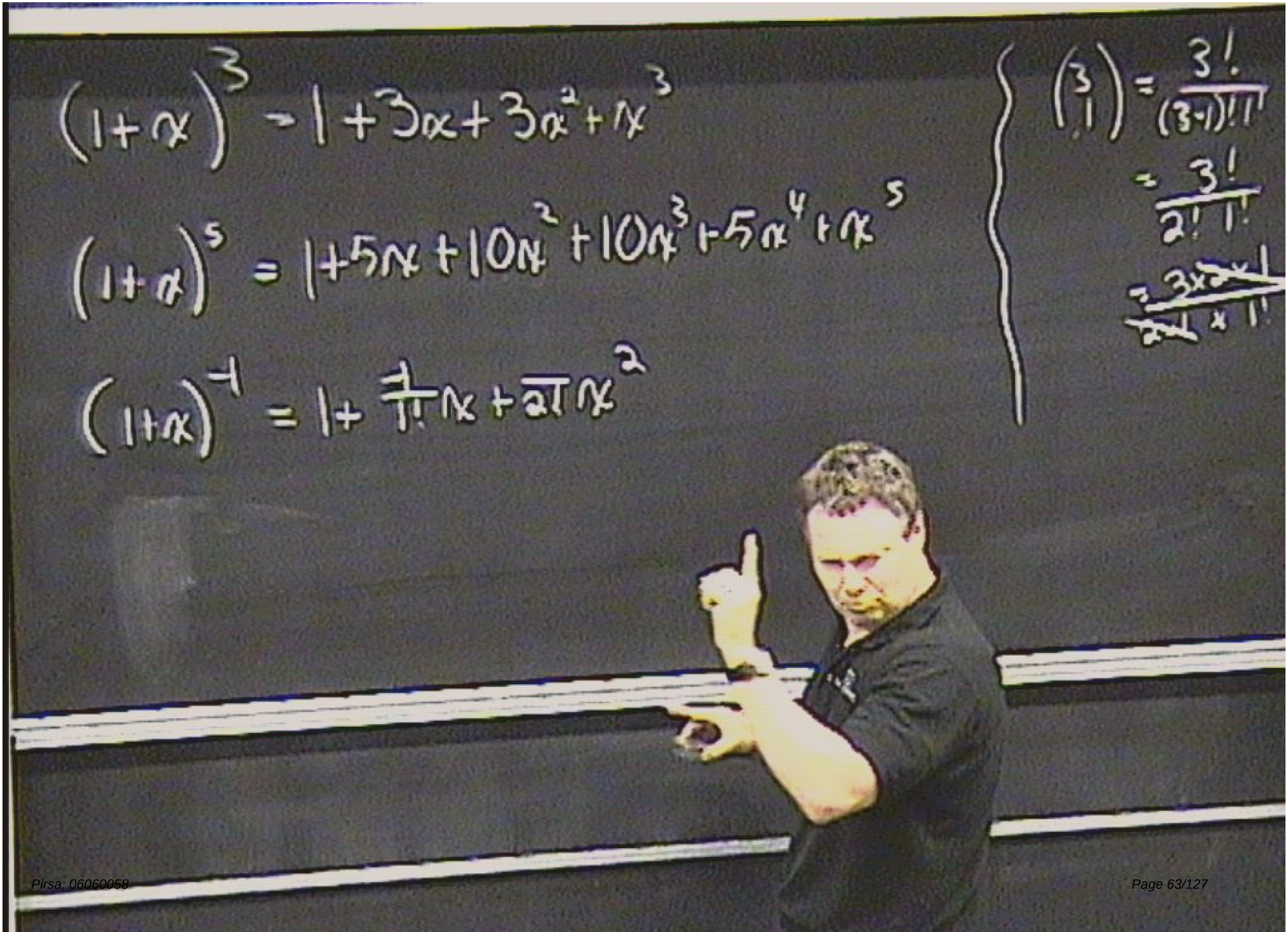

$(1+x)^3 = 1+3x+3x^2+x^3$
$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$
$(1+x)^{-1} = 1+$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$
$= \frac{3\times\cancel{2\times1}}{\cancel{2\times1}\times 1!}$

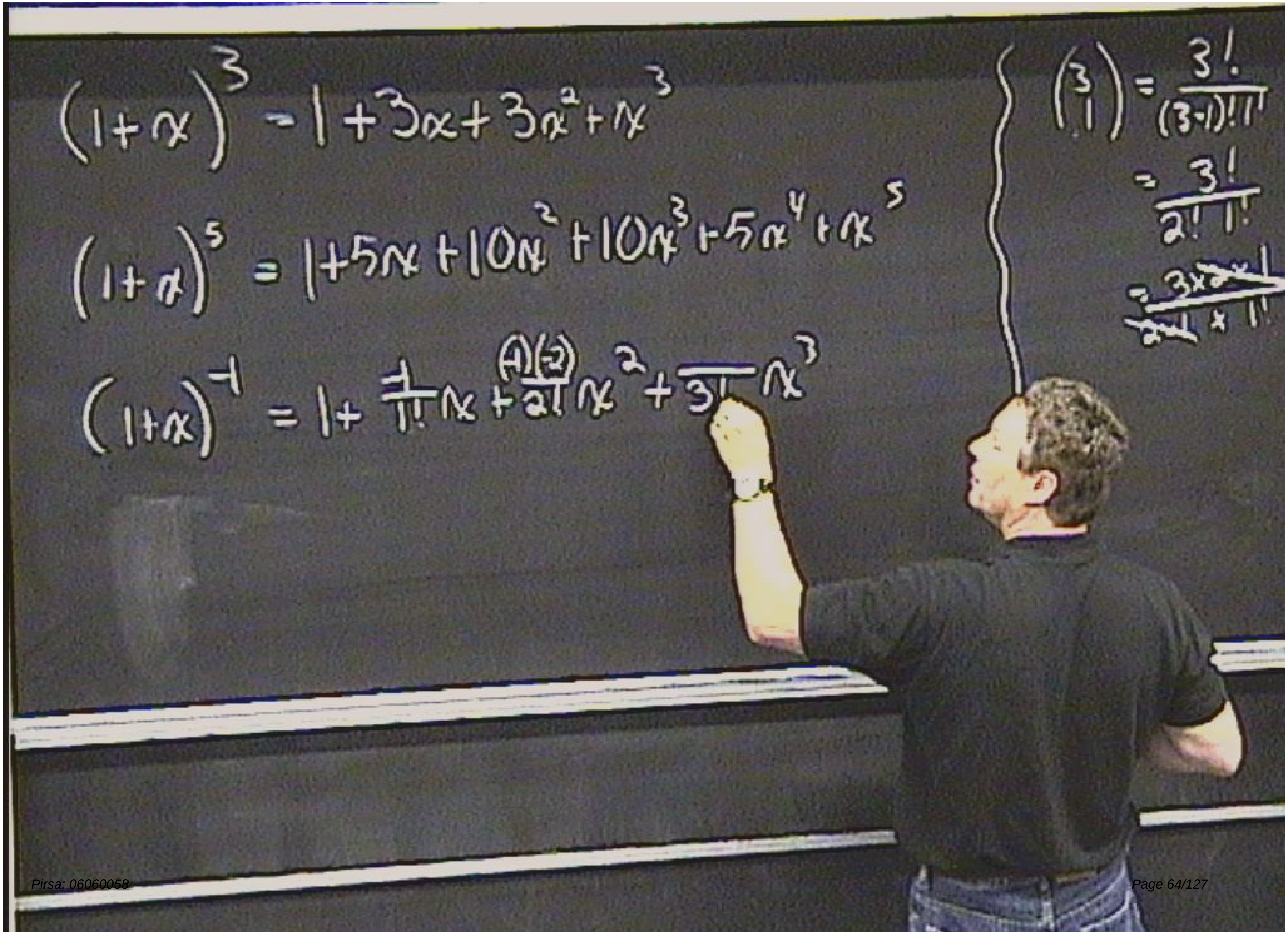
$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

$$(1+x)^{-1} = 1 + \frac{-1}{1!}$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3\times 2\times 1}{2\times 1}$$


(1+x)^3 = 1+3x+3x^2+x^3
(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5
(1+x)^-1 = 1+
(3 1) = 3!/((3-1)!1!)
= 3!/(2! 1!)



$(1+x)^3 = 1+3x+3x^2+x^3$
$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$
$(1+x)^{-1} = 1+\frac{-1}{1!}x+\frac{(-1)(-2)}{2!}x^2+\frac{\quad}{3!}x^3$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$
$= \cancel{\frac{3\times 2\times 1}{2\times 1\times 1!}}$

$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

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

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \cancel{\frac{3\times 2\times 1}{2\times 1 \times 1!}}$$

$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

$$(1+x)^{-1} = 1 + \frac{-1}{1!}x + \frac{(-1)(-2)}{2!}x^2 + \frac{(-1)(-2)(-3)}{3!}x^3 + \cdots$$

$$= 1$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3\times\cancel{2\times1}}{\cancel{2\times1}\times 1!}$$

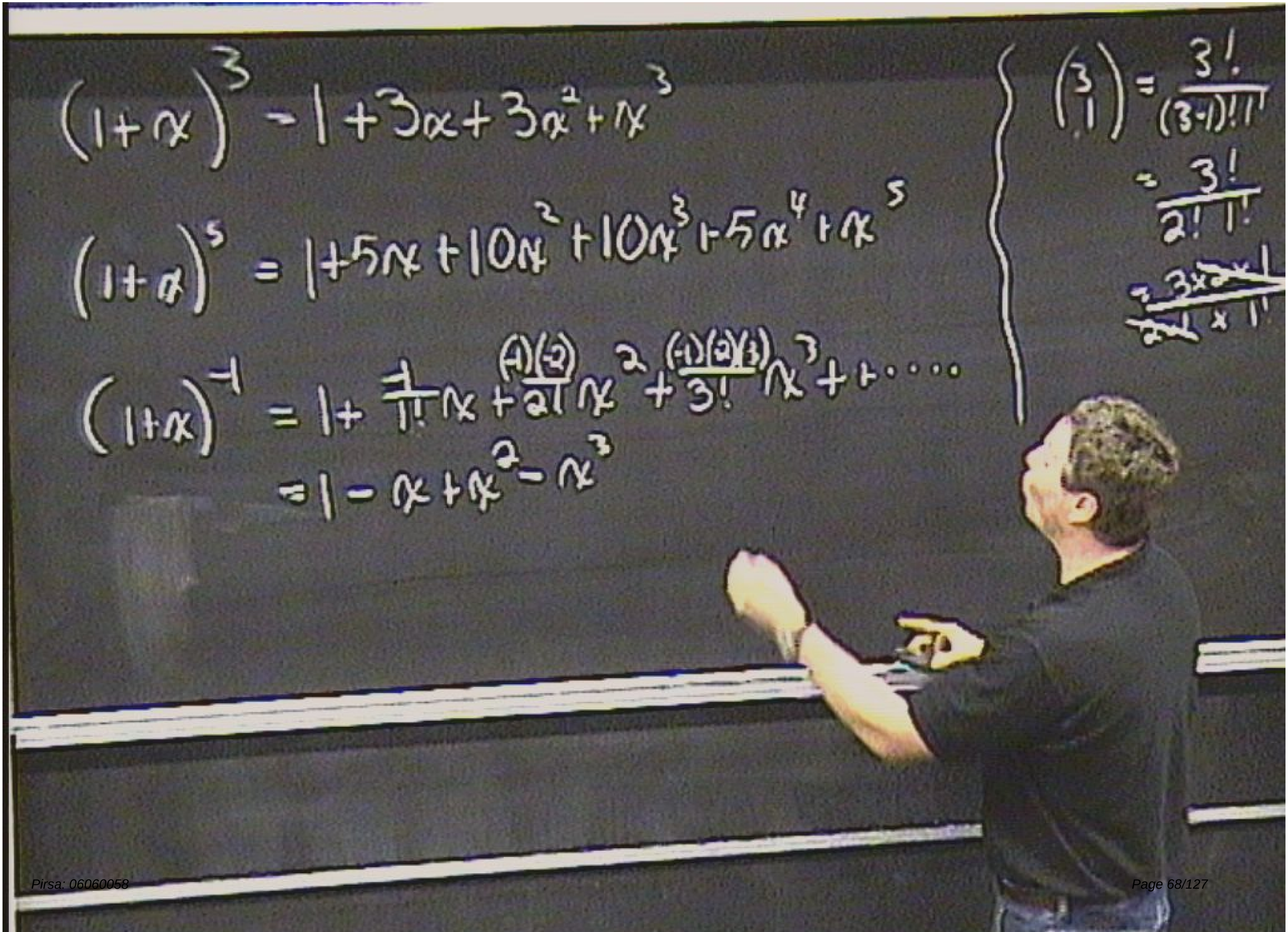
$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

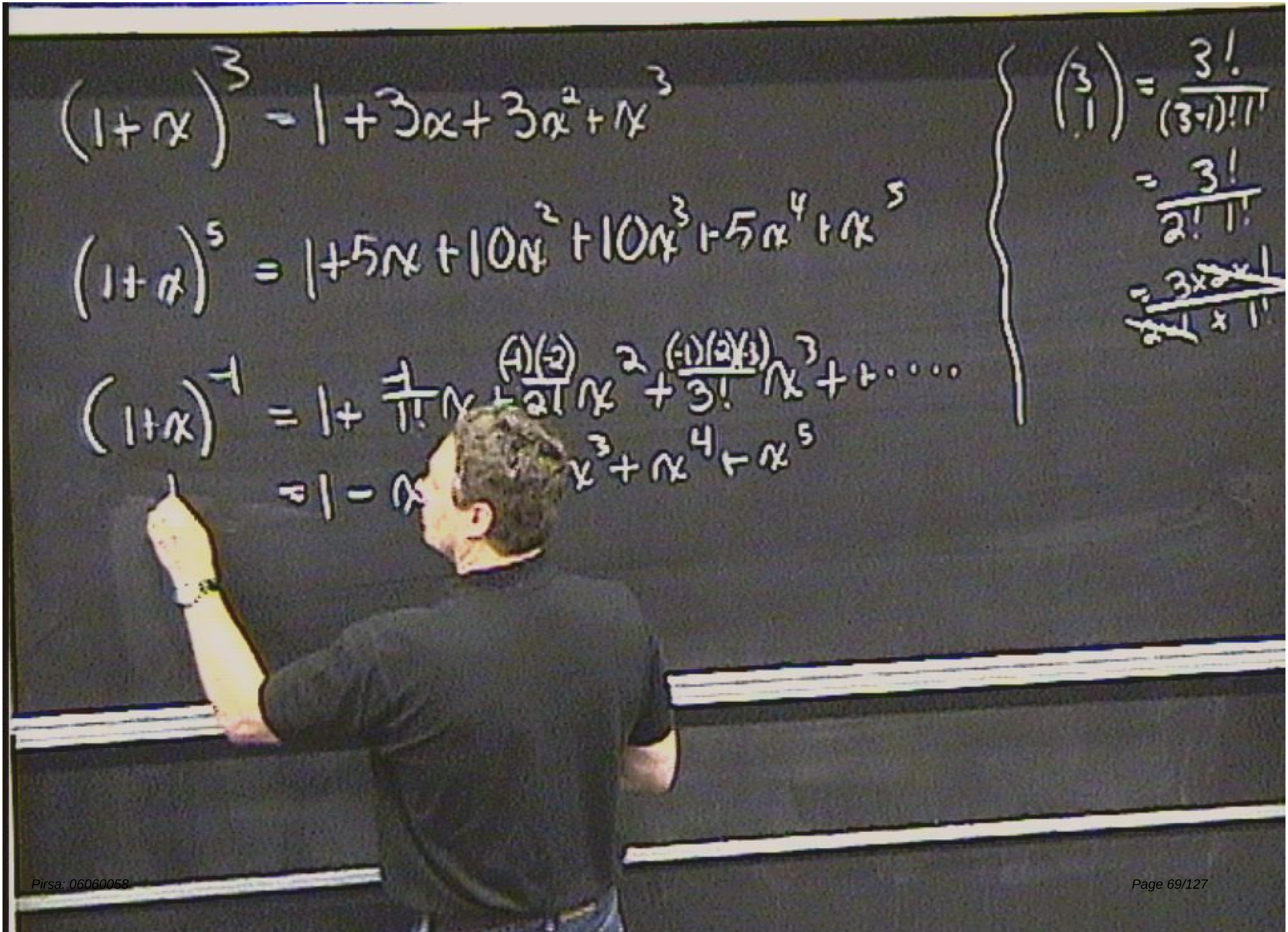
$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

$$(1+x)^{-1} = 1 + \frac{-1}{1!}x + \frac{(-1)(-2)}{2!}x^2 + \frac{(-1)(-2)(-3)}{3!}x^3 + \cdots$$

$$= 1 - x + x^2$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \frac{3 \times \cancel{2 \times 1}}{\cancel{2 \times 1} \times 1!}$$


$(1+x)^3 = 1+3x+3x^2+x^3$
$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$
$(1+x)^{-1} = 1+\frac{-1}{1!}x+\frac{(-1)(-2)}{2!}x^2+\frac{(-1)(-2)(-3)}{3!}x^3+\cdots$
$= 1-x+x^2-x^3$
$\binom{3}{1} = \frac{3!}{(3-1)!1!}$
$= \frac{3!}{2!\,1!}$
$\cancel{= \frac{3\times 2\times 1}{2\times 1\times 1!}}$



$(1+x)^3 = 1 + 3x + 3x^2 + x^3$
$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$
$(1+x)^{-1} = 1 + \frac{-1}{1!}x + \frac{(-1)(-2)}{2!}x^2 + \frac{(-1)(-2)(-3)}{3!}x^3 + \cdots$
$= 1 - x$
$x^3 + x^4 + x^5$
$\binom{3}{1} = \frac{3!}{(3-1)!\,1!}$
$= \frac{3!}{2!\,1!}$
$= \frac{3 \times 2 \times 1}{2 \times 1 \times 1!}$

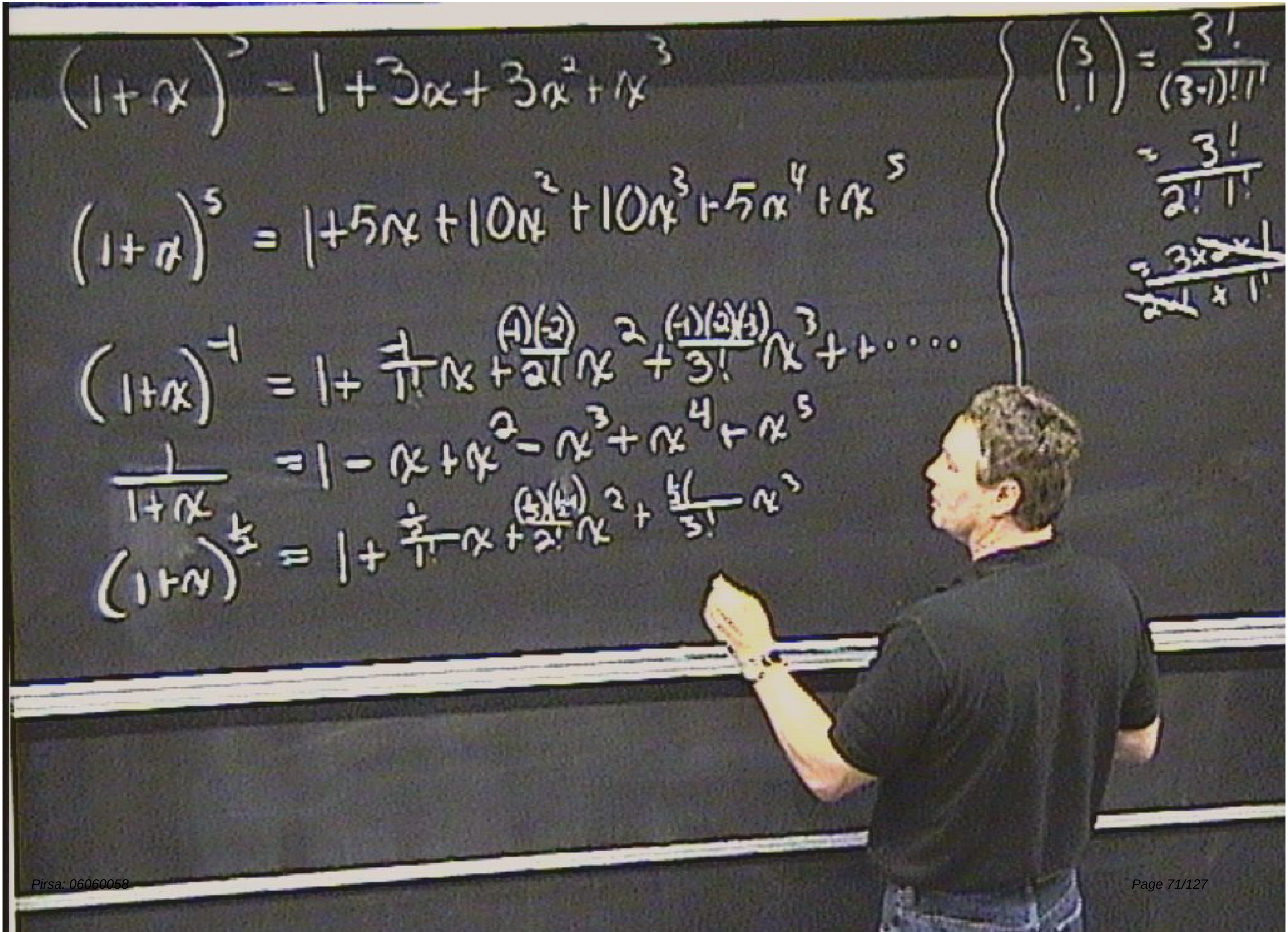
$$(1+x)^3 = 1 + 3x + 3x^2 + x^3$$

$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

$$(1+x)^{-1} = 1 + \frac{-1}{1!}x + \frac{(-1)(-2)}{2!}x^2 + \frac{(-1)(-2)(-3)}{3!}x^3 + \cdots$$

$$\frac{1}{1+x} = 1 - x + x^2 - x^3 + x^4 - x^5$$

$$\binom{3}{1} = \frac{3!}{(3-1)!\,1!} = \frac{3!}{2!\,1!} = \cancel{\frac{3 \times 2 \times 1}{2 \times 1 \times 1!}}$$


(1+x)^3 = 1+3x+3x^2+x^3
(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5
(1+x)^-1 = 1 + (-1)/1! x + (-1)(-2)/2! x^2 + (-1)(-2)(-3)/3! x^3 + ...
1/(1+x) = 1 - x + x^2 - x^3 + x^4 - x^5
(1+x)^1/2 = 1 + (1/2)/1! x + (1/2)(-1/2)/2! x^2 + (1/2)/3! x^3
(3 1) = 3!/((3-1)! 1!)
= 3!/(2! 1!)
= 3×2×1/(2×1 × 1)

$$(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$$

$$(1+x)^{-1} = 1 + \frac{-1}{1!}x + \frac{(-1)(-2)}{2!}x^2 + \frac{(-1)(-2)(-3)}{3!}x^3 + \cdots$$

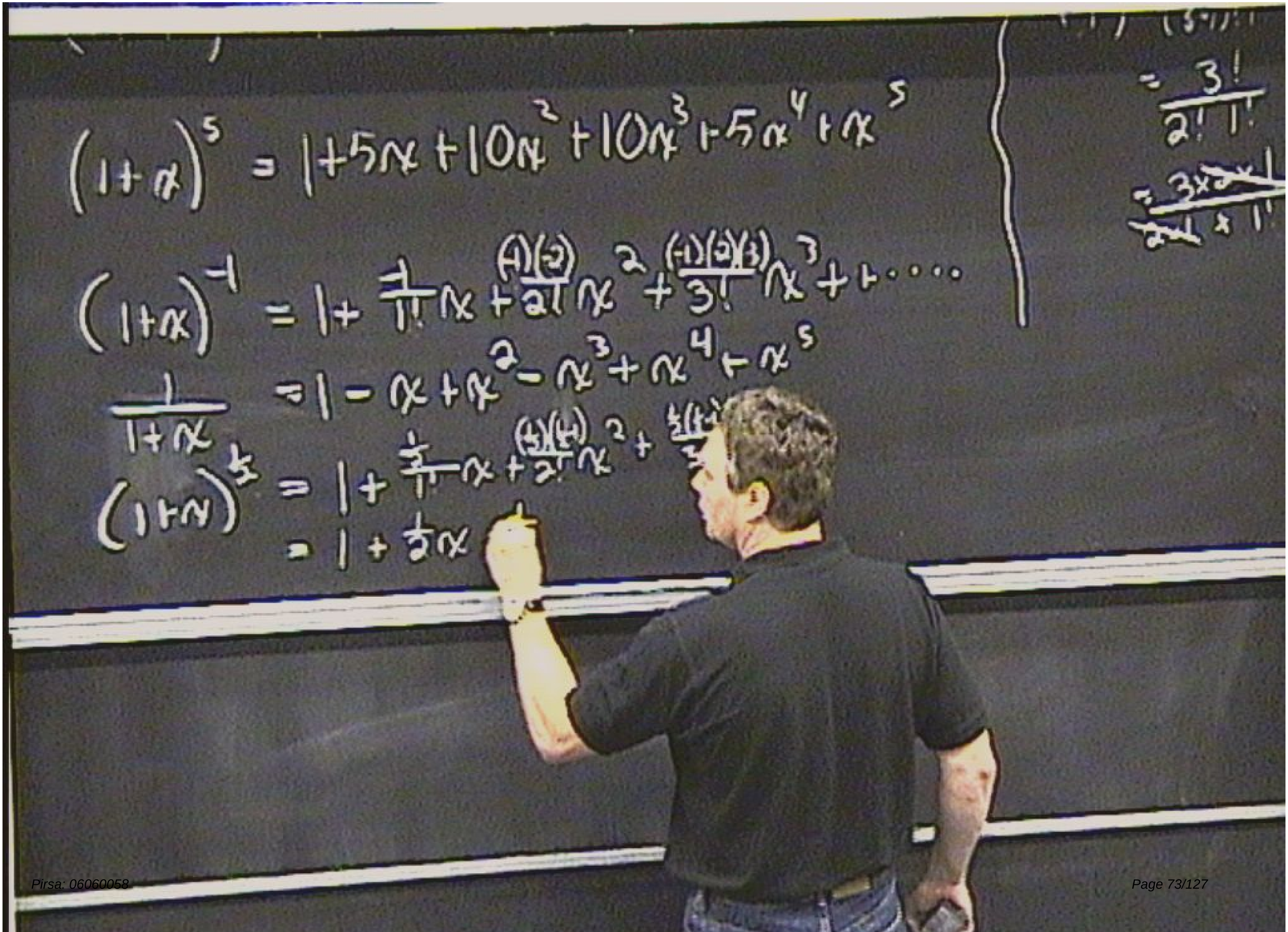
$$\frac{1}{1+x} = 1 - x + x^2 - x^3 + x^4 - x^5$$

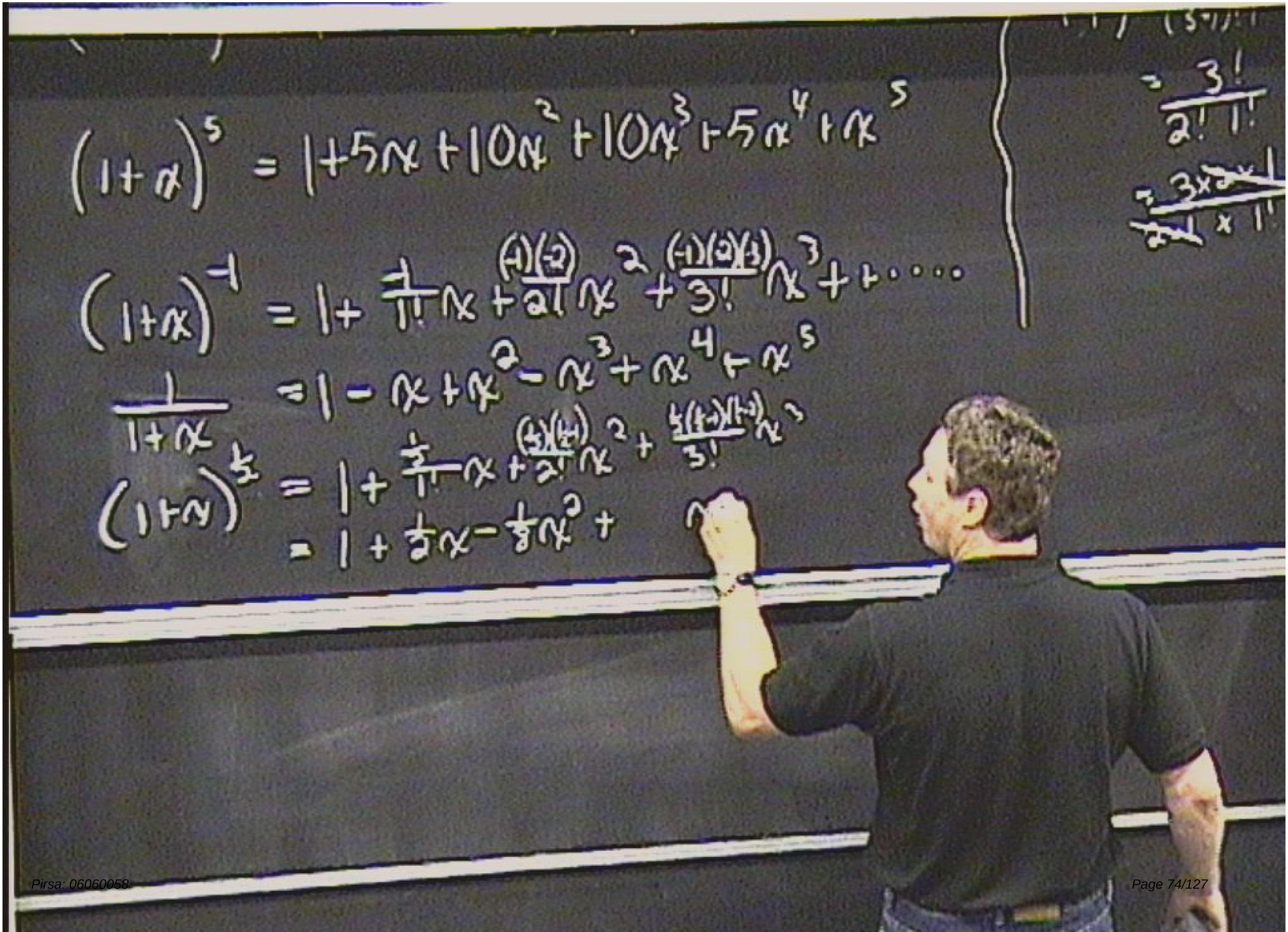
$$(1+x)^{\frac{1}{2}} = 1 + \frac{\frac{1}{2}}{1!}x + \frac{(\frac{1}{2})(-\frac{1}{2})}{2!}x^2 + \frac{\frac{1}{2}(\frac{1}{2}-1)(\frac{1}{2}-2)}{3!}x^3$$

$$=$$

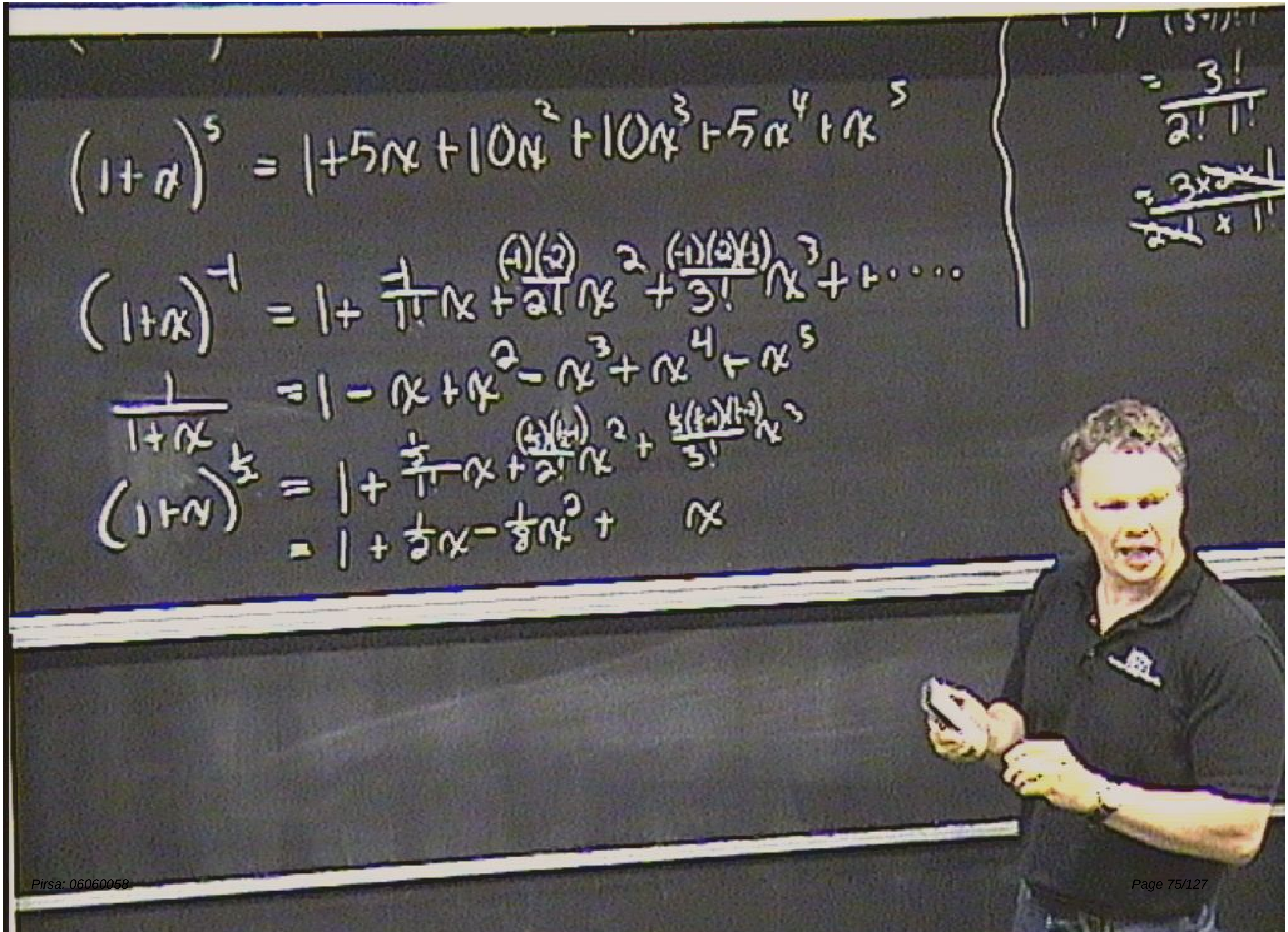
$$= \frac{3!}{2!\,1!}$$

$$= \frac{3 \times \cancel{2 \times 1}}{\cancel{2 \times 1} \times 1!}$$


(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5
(1+x)^-1 = 1 + -1/1! x + (-1)(-2)/2! x^2 + (-1)(-2)(-3)/3! x^3 + ...
1/(1+x) = 1 - x + x^2 - x^3 + x^4 - x^5
(1+x)^½ = 1 + ½/1 x + (½)(-½)/2! x^2 +
= 1 + ½x
= 3!/(2! 1!)



$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$
$(1+x)^{-1} = 1 + \frac{-1}{1!}x + \frac{(-1)(-2)}{2!}x^2 + \frac{(-1)(-2)(-3)}{3!}x^3 + \cdots$
$\frac{1}{1+x} = 1 - x + x^2 - x^3 + x^4 - x^5$
$(1+x)^{\frac{1}{2}} = 1 + \frac{\frac{1}{2}}{1!}x + \frac{(\frac{1}{2})(-\frac{1}{2})}{2!}x^2 + \frac{\frac{1}{2}(\frac{1}{2}-1)(\frac{1}{2}-2)}{3!}x^3$
$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 +$
$= \frac{3!}{2!\,1!}$



$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$
$(1+x)^{-1} = 1+\frac{-1}{1!}x+\frac{(-1)(-2)}{2!}x^2+\frac{(-1)(-2)(-3)}{3!}x^3+\cdots$
$\frac{1}{1+x} = 1-x+x^2-x^3+x^4-x^5$
$(1+x)^{\frac{1}{2}} = 1+\frac{\frac{1}{2}}{1!}x+\frac{(\frac{1}{2})(-\frac{1}{2})}{2!}x^2+\frac{\frac{1}{2}(\frac{1}{2}-1)(\frac{1}{2}-2)}{3!}x^3$
$= 1+\frac{1}{2}x-\frac{1}{8}x^2+ \quad x$
$= \frac{3!}{2!\,1!}$
$= \frac{3\times 2\times 1}{2\times 1 \times 1!}$

$$(1+x)^5 = 1+5x+10x^2+10x^3+5x^4+x^5$$

$$(1+x)^{-1} = 1+\frac{-1}{1!}x+\frac{(-1)(-2)}{2!}x^2+\frac{(-1)(-2)(-3)}{3!}x^3+\cdots$$

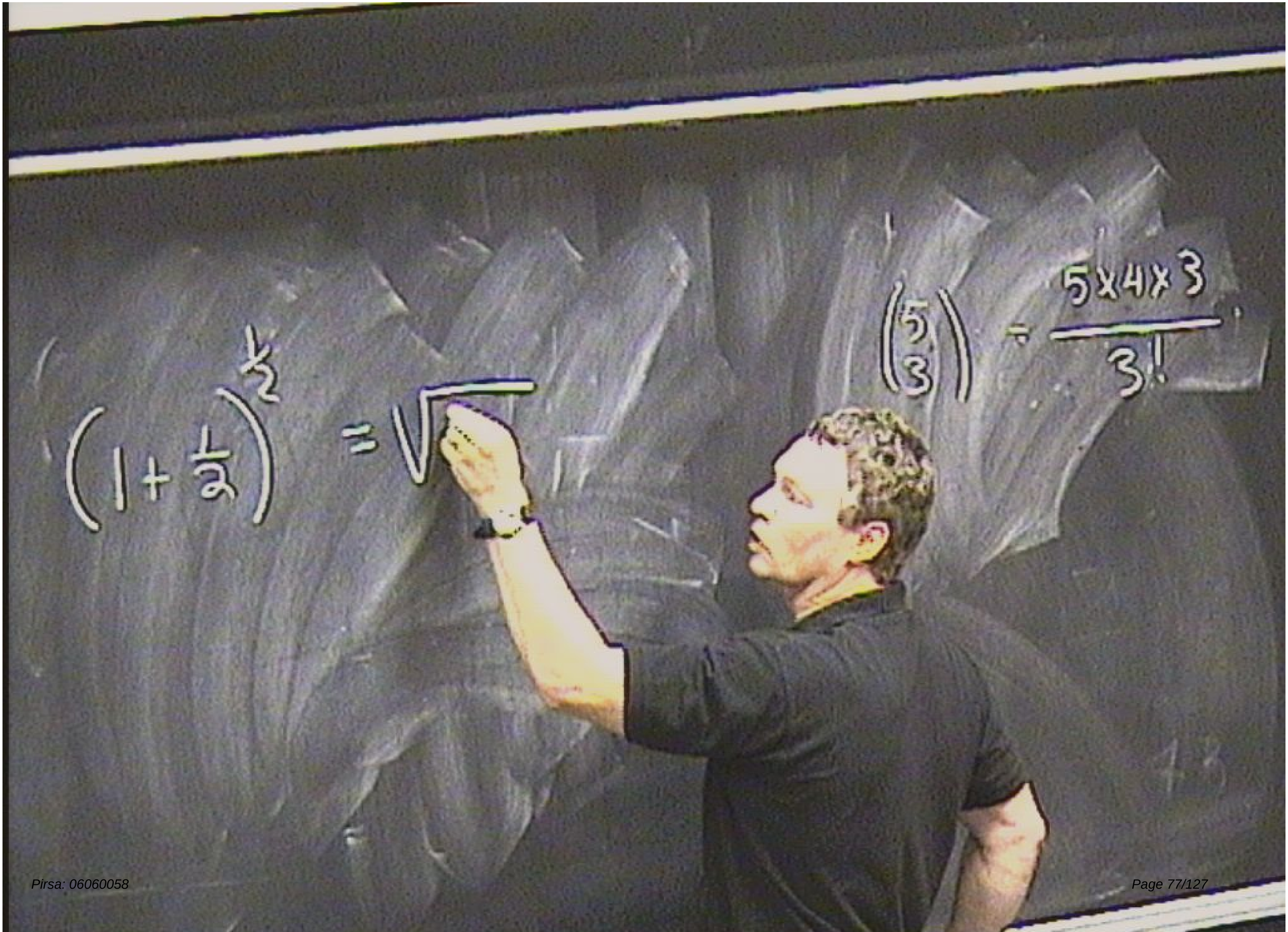
$$\frac{1}{1+x} = 1-x+x^2-x^3+x^4-x^5$$

$$(1+x)^{\frac{1}{2}} = 1+\frac{\frac{1}{2}}{1!}x+\frac{(\frac{1}{2})(\frac{1}{2}-1)}{2!}x^2+\frac{\frac{1}{2}(\frac{1}{2}-1)(\frac{1}{2}-2)}{3!}x^3 \cdots\cdots$$

$$= 1+\frac{1}{2}x-\frac{1}{8}x^2+\frac{1}{16}x^3-\cdots\cdots$$

$$= \frac{3!}{2!\,1!}$$

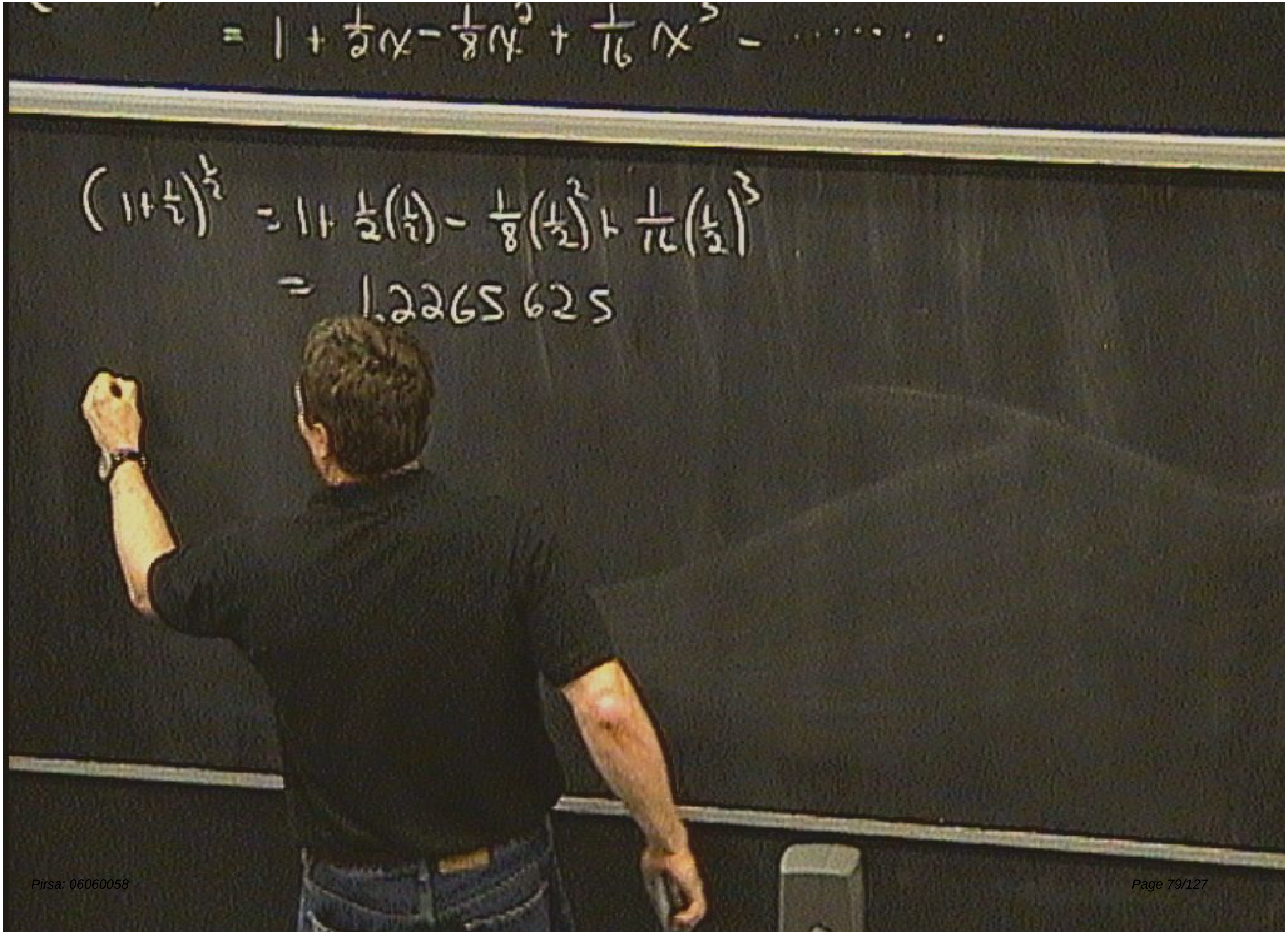
$$= \cancel{\frac{3\times 2\times 1}{2\times 1\times 1!}}$$

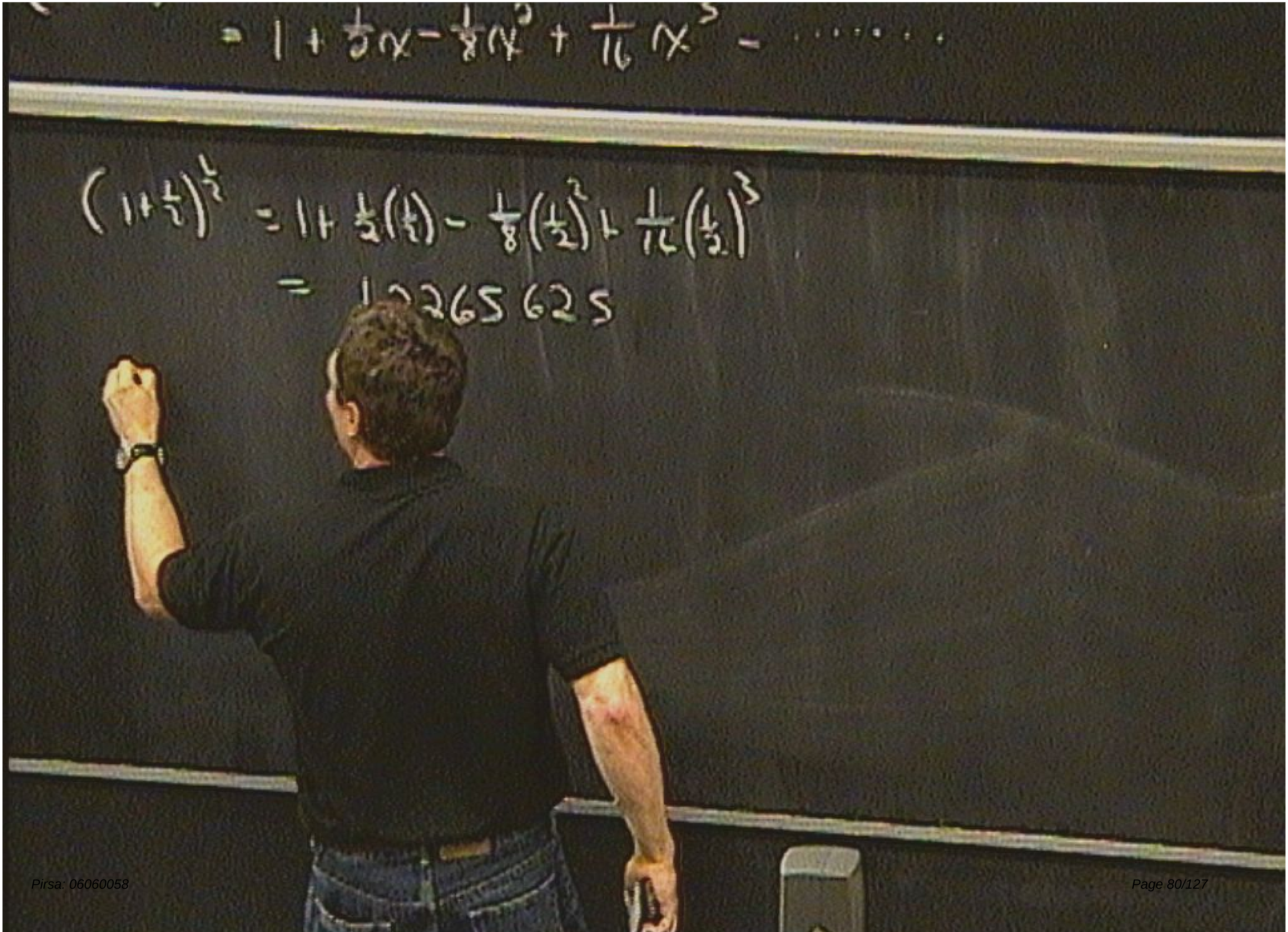

$(1+\frac{1}{2})^{\frac{1}{2}} = \sqrt{}$
$\binom{5}{3} = \frac{5\times4\times3}{3!}$

$$\left(1+\frac{1}{2}\right)^{1/2} = \sqrt{1.5}$$

x

$$\binom{5}{3} = \frac{5\times 4\times 3}{3!}$$


$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \ldots\ldots$
$(1+\frac{1}{2})^{\frac{1}{2}} = 1 + \frac{1}{2}(\frac{1}{2}) - \frac{1}{8}(\frac{1}{2})^2 + \frac{1}{16}(\frac{1}{2})^3$
$= 1.2265625$



$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \ldots\ldots$
$(1+\frac{1}{2})^{\frac{1}{2}} = 1 + \frac{1}{2}(\frac{1}{2}) - \frac{1}{8}(\frac{1}{2})^2 + \frac{1}{16}(\frac{1}{2})^3$
$= 1\,2265625$

$$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \cdots\cdots$$

$$\left(1+\frac{1}{2}\right)^{\frac{1}{2}} = 1 + \frac{1}{2}\left(\frac{1}{2}\right) - \frac{1}{8}\left(\frac{1}{2}\right)^2 + \frac{1}{16}\left(\frac{1}{2}\right)^3$$

$$= 1.2265625$$

$$\sqrt{1.5} = 1.22474\cdots\cdots$$

$$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \cdots\cdots$$

$$\left(1+\frac{1}{2}\right)^{\frac{1}{2}} = 1 + \frac{1}{2}\left(\frac{1}{2}\right) - \frac{1}{8}\left(\frac{1}{2}\right)^2 + \frac{1}{16}\left(\frac{1}{2}\right)^3$$

$$= \underline{1.22}65625$$

$$\sqrt{1.5} = \underline{1.22}474\cdots\cdots$$

$$(1+x)^n = 1 + nx$$

$$x \ll 1$$

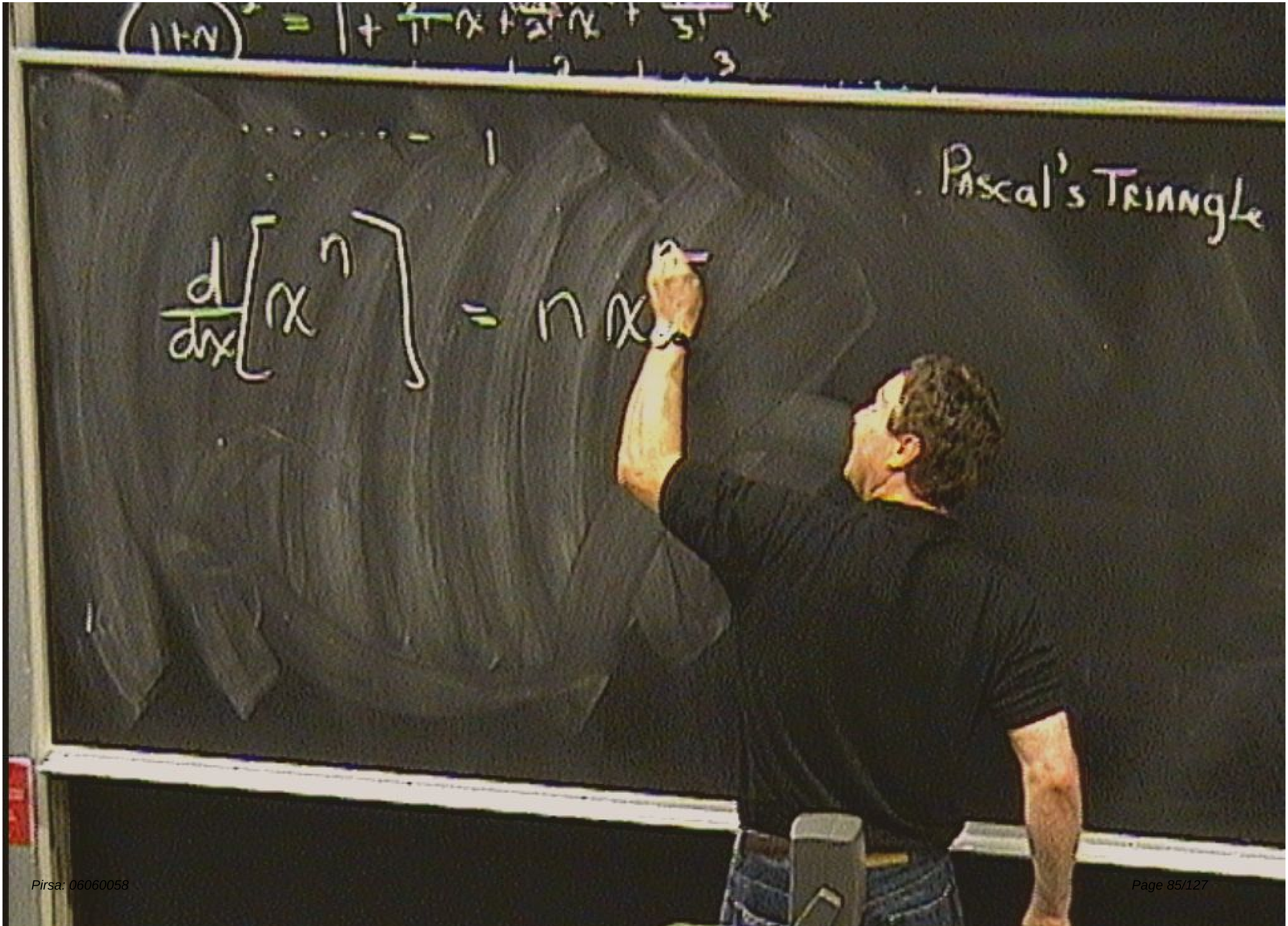
$$\left(1+\tfrac{1}{2}\right)^{\frac{1}{2}} = 1 + \tfrac{1}{4}$$

$=$

$$(1+x)^n = 1+nx$$

$$x \ll 1$$

$$\left(1+\tfrac{1}{2}\right)^{\frac{1}{2}} = 1+\tfrac{1}{4}$$
$$= 1.25$$


Pascal's Triangle
$\frac{d}{dx}[x^n] = n x$

$$\frac{d}{dx}\left[x^{n}\right] = n x^{n-1}$$

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

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

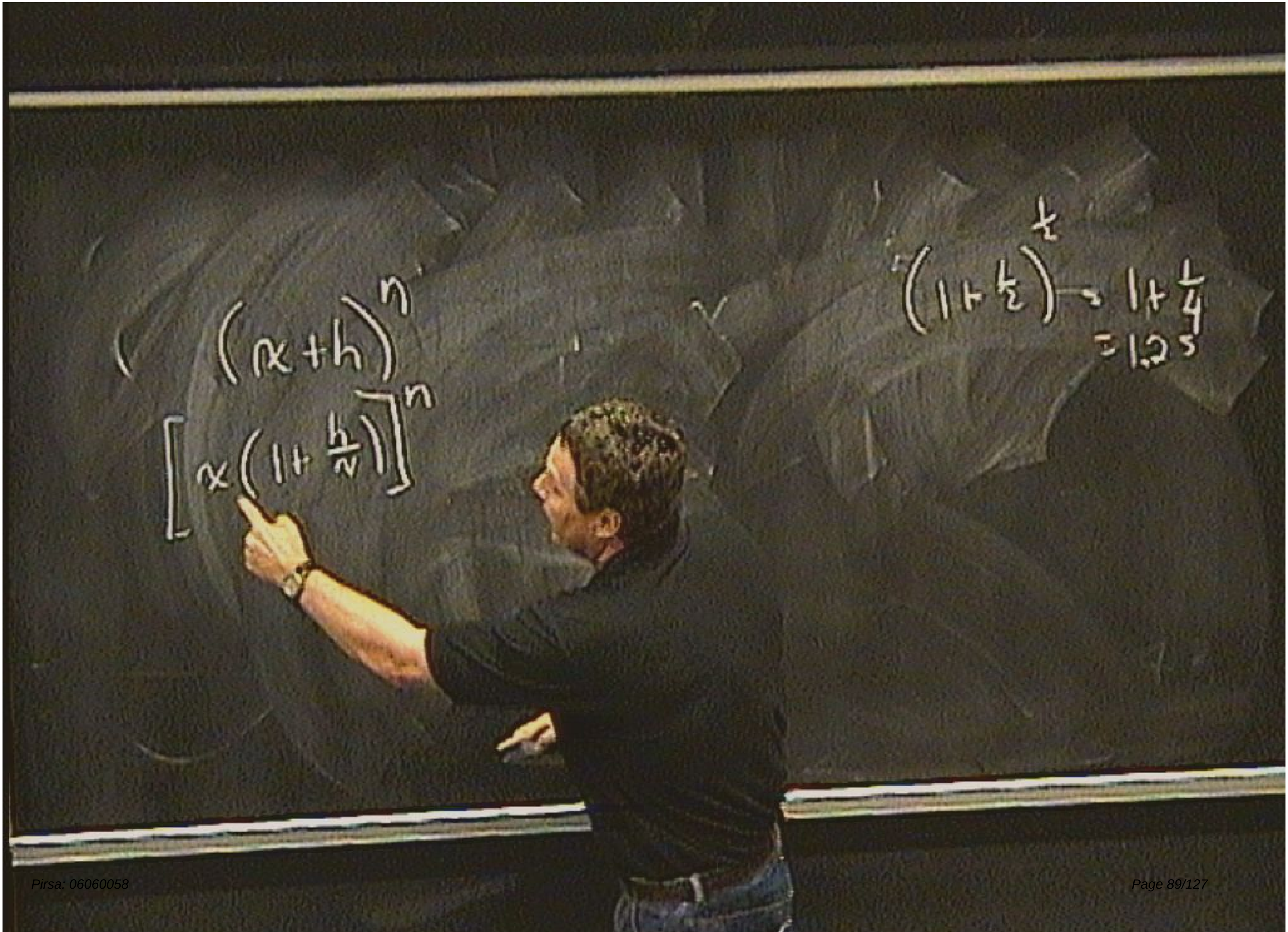
$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

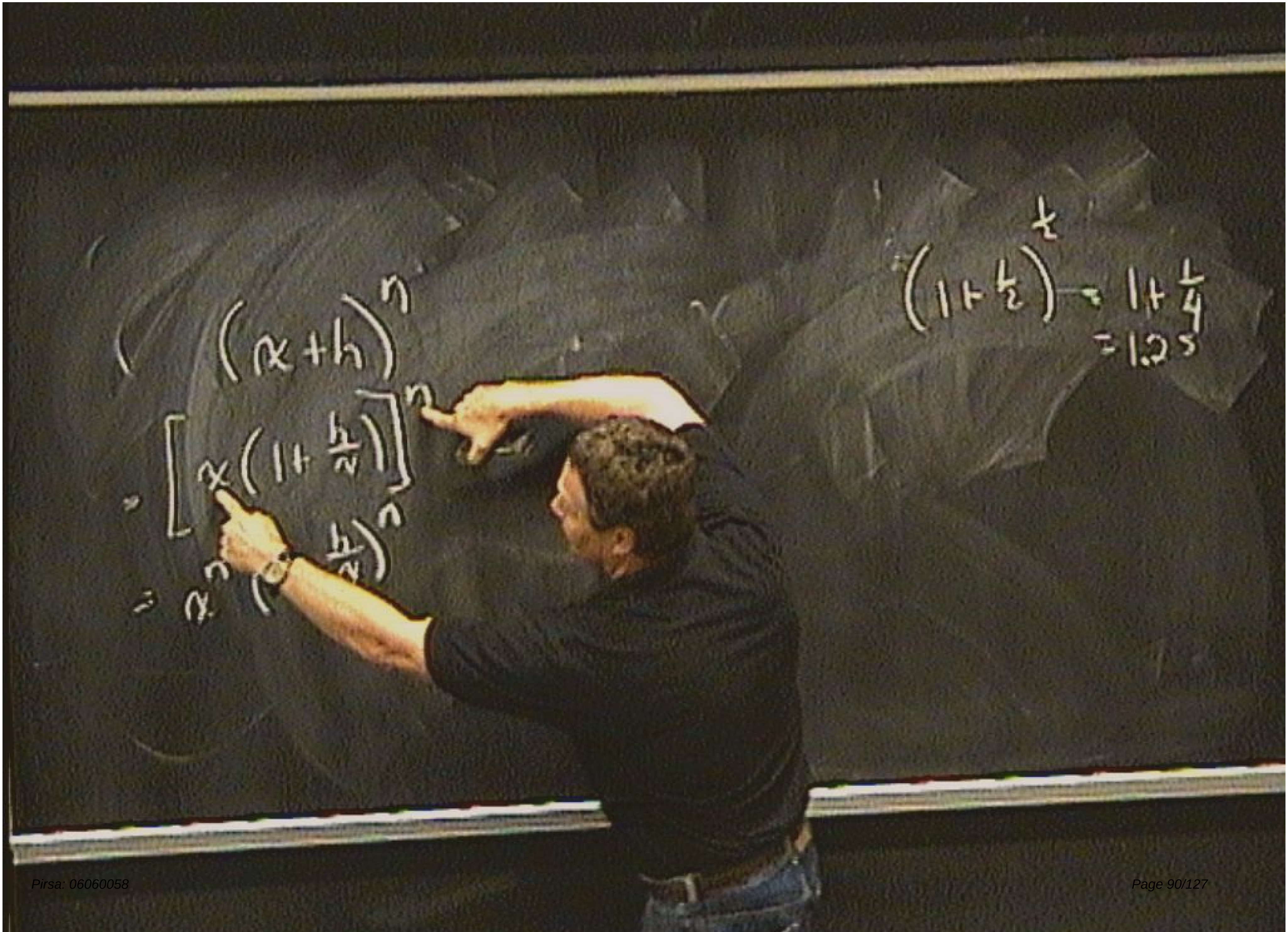
$$\lim_{h \to 0} \frac{(x+h)^n - x^n}{h}$$

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

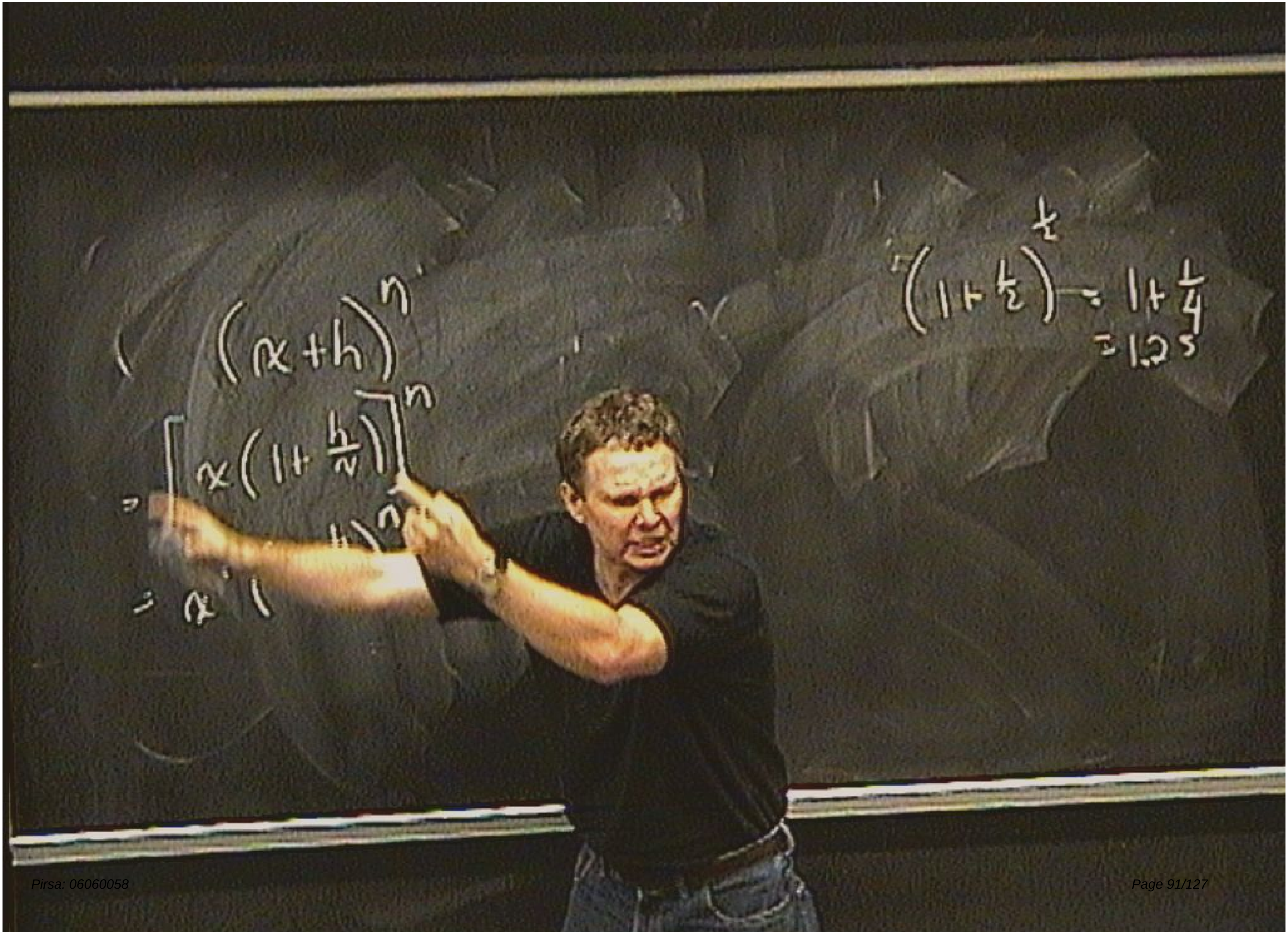
$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

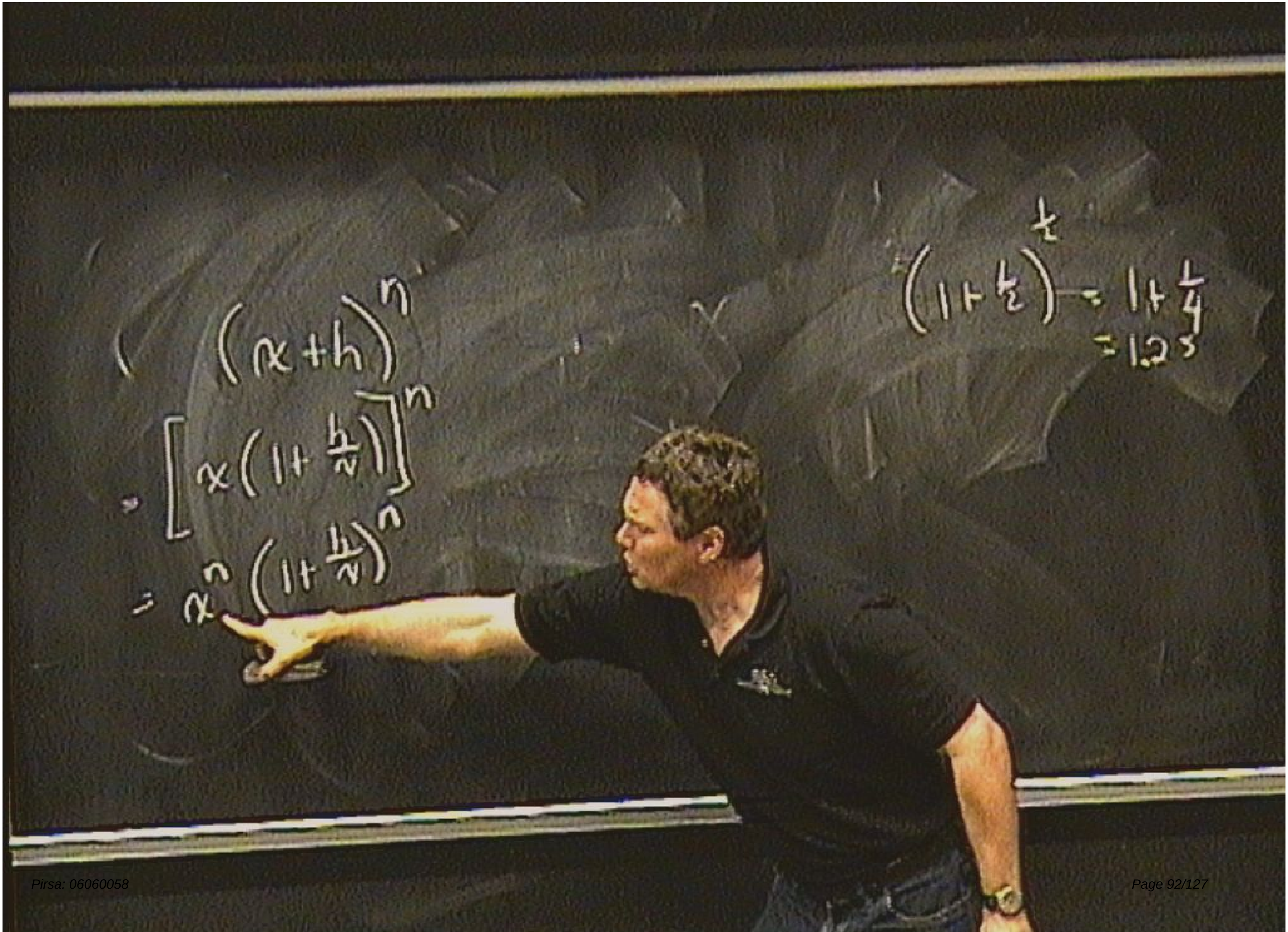
$$\lim_{h \to 0} \frac{(x+h)^n - x^n}{h}$$


$(x+h)^n$
$\left[x\left(1+\frac{h}{x}\right)\right]^n$
$\left(1+\frac{1}{2}\right)^{\frac{1}{2}} \to 1+\frac{1}{4}$
$=1.25$



(x+h)^n
= [x(1+h/x)]^n
= x^n (1+h/x)^n
= 1.25


$(x+h)^n$
$= \left[x\left(1+\frac{h}{x}\right)\right]^n$
$\left(1+\frac{1}{2}\right)^{\frac{1}{2}} \approx 1+\frac{1}{4}$
$= 1.25$


(x+h)^n
= [x(1+h/x)]^n
= x^n (1+h/x)^n
(1+1/2)^(1/2) = 1+1/4
= 1.25

$$(x+h)^n$$

$$= \left[x\left(1+\frac{h}{x}\right)\right]^n$$

$$= x^n\left(1+\frac{h}{x}\right)^n$$

$$\left(1+\frac{1}{2}\right)^{\frac{1}{2}} \to = 1+\frac{1}{4}$$

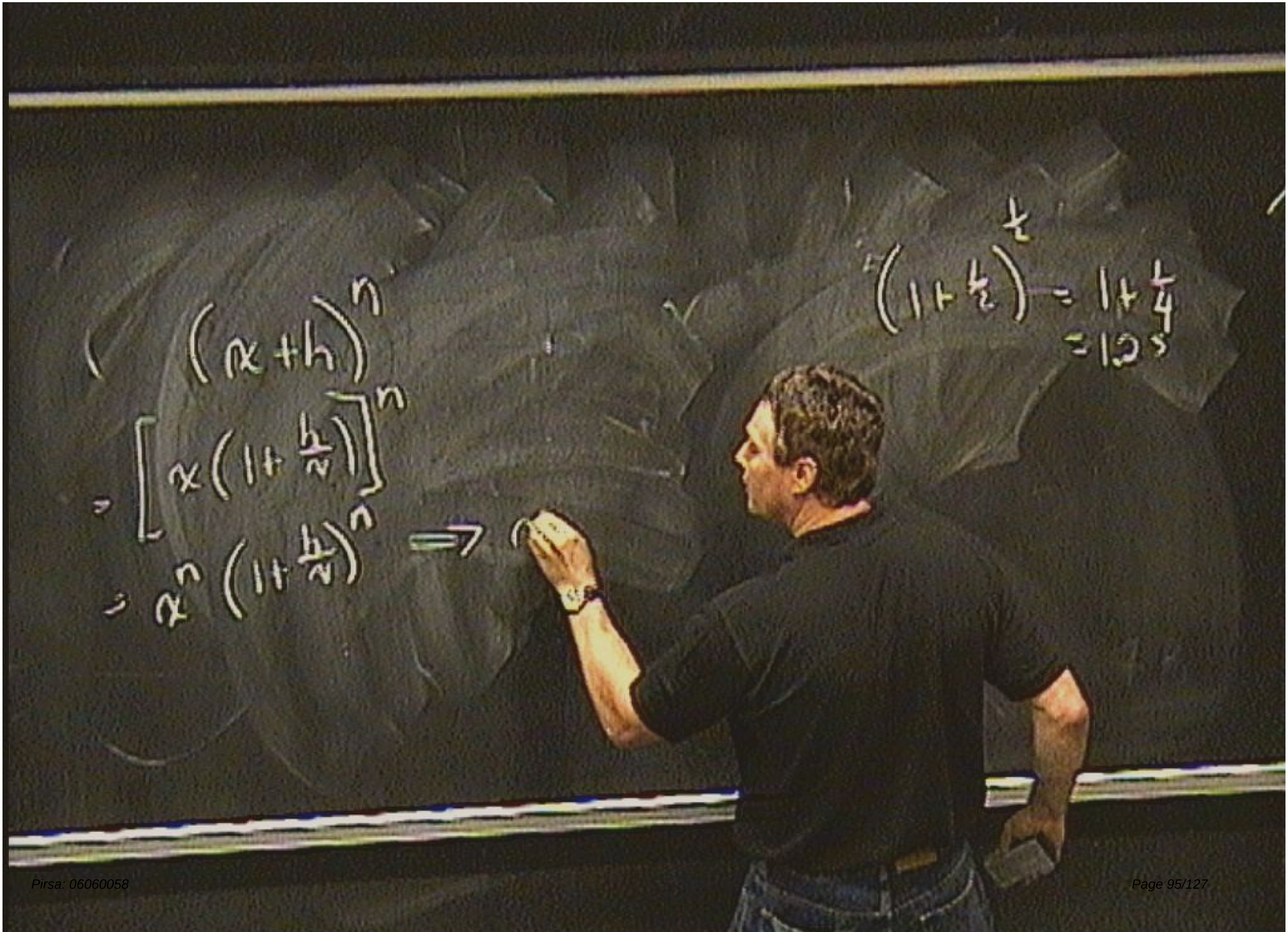
$$= 1.25$$

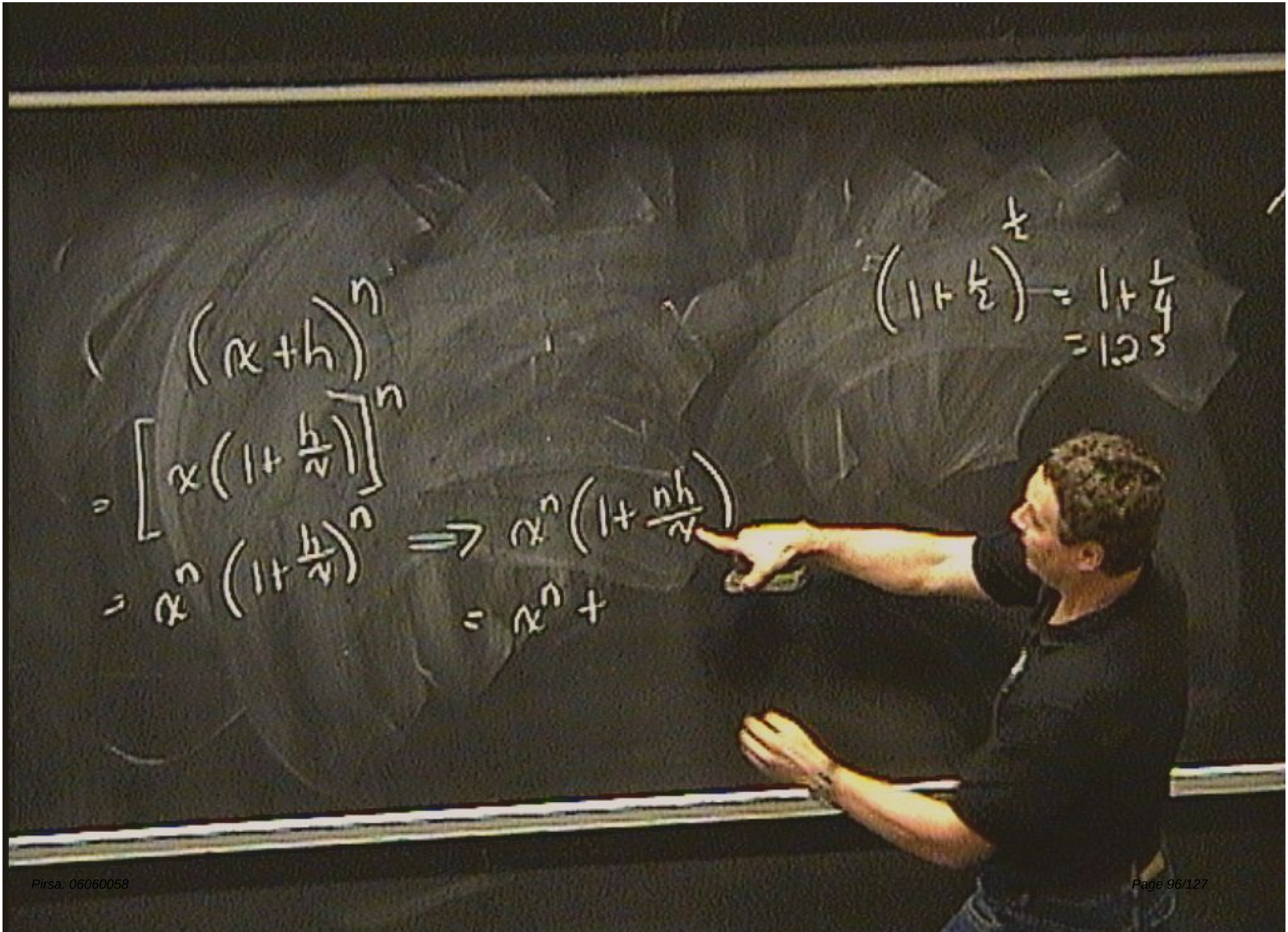
$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

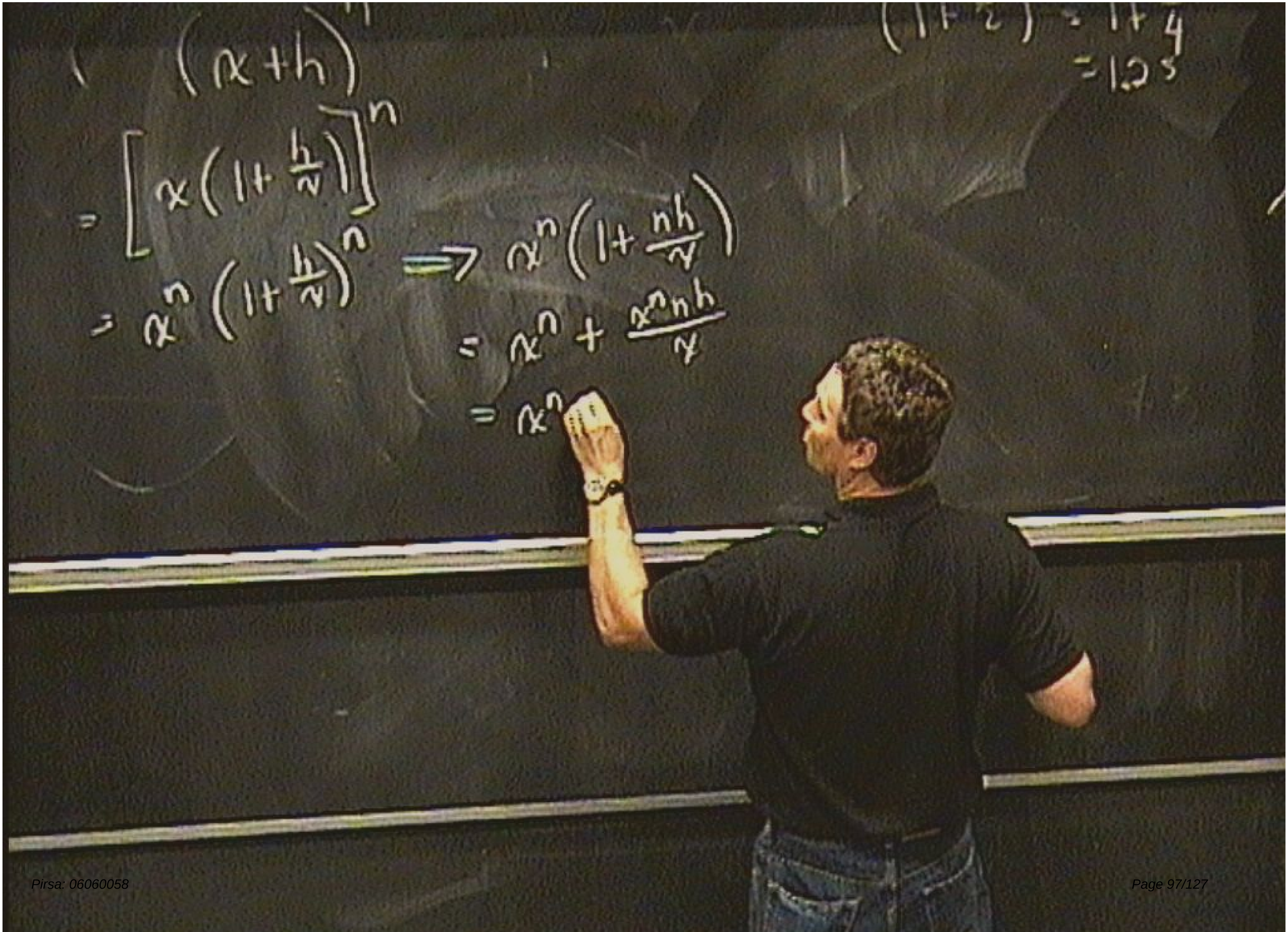
$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

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

$$\lim_{h \to 0} \frac{x^n\left(1+\frac{h}{x}\right)^n - x^n}{h}$$


(x+h)^n
= [x(1+h/x)]^n
= x^n (1+h/x)^n ⟹
= 1.25


$(x+h)^n$
$= \left[x\left(1+\frac{h}{x}\right)\right]^n$
$= x^n\left(1+\frac{h}{x}\right)^n \Longrightarrow x^n\left(1+\frac{nh}{x}\right)$
$= x^n +$
$\left(1+\frac{1}{2}\right)^{\frac{1}{2}} = 1+\frac{1}{4}$
$= 1.25$



(x+h)^n
= [x(1+h/x)]^n
= x^n (1+h/x)^n ⟹ x^n(1+nh/x)
= x^n + x^n nh/x
= x^n
=1.25

$$(x+h)^n$$

$$= \left[x\left(1+\frac{h}{x}\right)\right]^n$$

$$= x^n\left(1+\frac{h}{x}\right)^n \Rightarrow x^n\left(1+\frac{nh}{x}\right)$$

$$= x^n + \frac{x^n nh}{x}$$

$$= x^n + x^{n-1}nh$$

$$\left(1+\frac{1}{2}\right) = 1+\frac{1}{4} = 1.25$$

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

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

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

$$\lim_{h\to 0} \frac{x^n\left(1+\frac{h}{x}\right)^n - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^n - x^{n-1}nh - x^n}{h}$$

$$\lim$$

$\sqrt{1.5} = 1.23474 \ldots$

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

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

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

$$\lim_{h\to 0} \frac{x^n\left(\left(1+\frac{h}{x}\right)^n - x^n\right)}{h}$$

$$\lim_{h\to 0} \frac{x^n + x^{n-1}nh - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^{n-1}nh}{h}$$

$$\sqrt{1.5} = \underline{1.22}474\cdots$$

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

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

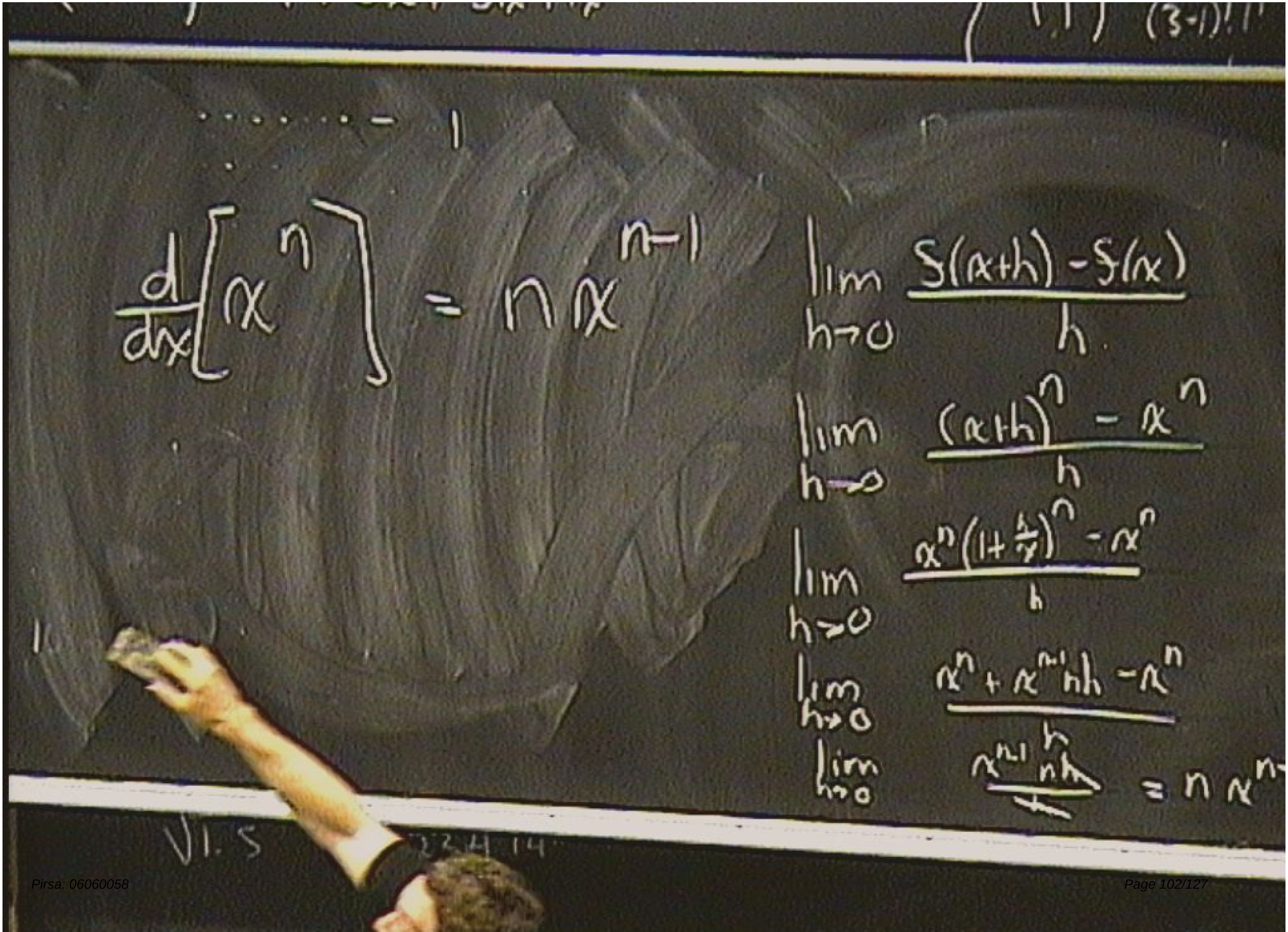
$$\lim_{h\to 0} \frac{(x+h)^n - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^n\left(1+\frac{h}{x}\right)^n - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^n + x^{n-1}nh - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^{n-1}n\cancel{h}}{\cancel{h}} = n x^{n-1}$$

$\sqrt{1.5} = 1.22474$



$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$
$\lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$
$\lim_{h\to 0} \frac{(x+h)^n - x^n}{h}$
$\lim_{h\to 0} \frac{x^n\left(1+\frac{h}{x}\right)^n - x^n}{h}$
$\lim_{h\to 0} \frac{x^n + x^{n-1}nh - x^n}{h}$
$\lim_{h\to 0} \frac{x^{n-1}n\cancel{h}}{\cancel{h}} = n x^{n-}$
VI.5

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

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

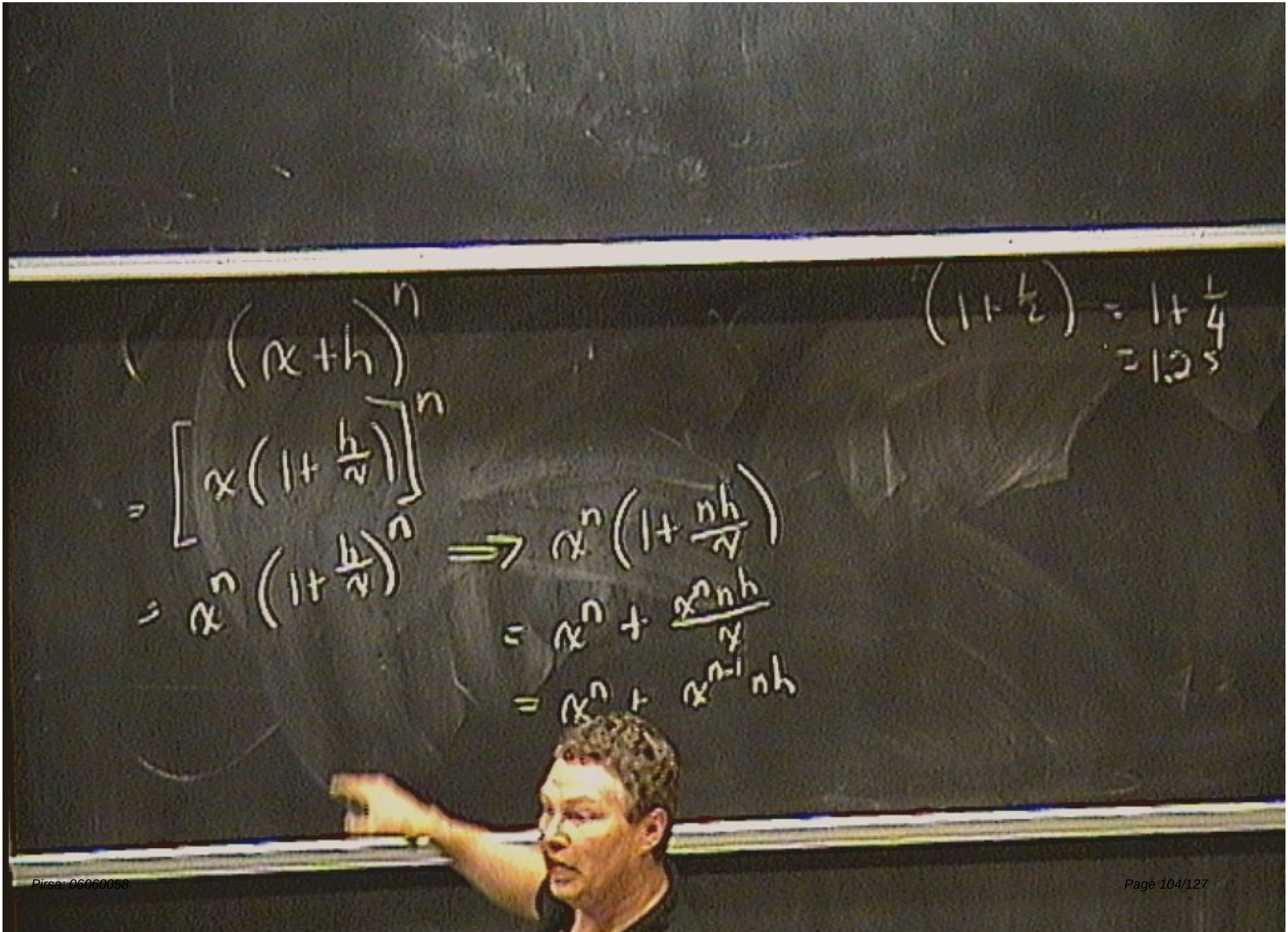
$$\lim_{h\to 0} \frac{(x+h)^n - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^n\left(1+\frac{h}{x}\right)^n - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^n + x^{n-1}nh - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^{n-1}n\cancel{h}}{\cancel{h}} = n x^{n-}$$

$\sqrt{1.5} = 1.234\ 14$


$(x+h)^n$
$= \left[x\left(1+\frac{h}{x}\right)\right]^n$
$= x^n\left(1+\frac{h}{x}\right)^n \Longrightarrow x^n\left(1+\frac{nh}{x}\right)$
$= x^n + \frac{x^n nh}{x}$
$= x^n + x^{n-1}nh$
$\left(1+\frac{1}{2}\right) = 1+\frac{1}{4}$
$= 1.25$

$$(1+\tfrac{1}{2}) = 1+\tfrac{1}{4}$$
$$= 1.25$$

$$(x+h)^n$$
$$= \left[x\left(1+\frac{h}{x}\right)\right]^n$$
$$= x^n\left(1+\frac{h}{x}\right)^n \Longrightarrow x^n\left(1+\frac{nh}{x}\right)$$
$$= x^n + \frac{x^n nh}{x}$$
$$= x^n + x^{n-1}nh$$

$$\frac{d}{dx}\left[x^n\right] = n x^{n-1}$$

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

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

$$\lim_{h\to 0} \frac{x^n\left(1+\frac{h}{x}\right)^n - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^n + x^{n-1} n h - x^n}{h}$$

$$\lim_{h\to 0} \frac{x^{n-1} n \cancel{h}}{\cancel{h}} = n x$$

$\lim_{h \to 0}$ ... $= n$

$(1+x)$

$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \cdots\cdots$

$$mc^2\left[\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1\right]$$

$$(a+b)^n = \binom{n}{0}a^n b^0 + \binom{n}{1}a^{n-1}b^1 + \binom{n}{2}a^{n-2}b^2 + \cdots + \binom{n}{r}a^{n-r}b^r + \cdots \binom{n}{n}a^0 b^n$$

$$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$$

$$1+y\,\overline{)\,1\qquad}$$

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

$$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \cdots\cdots$$

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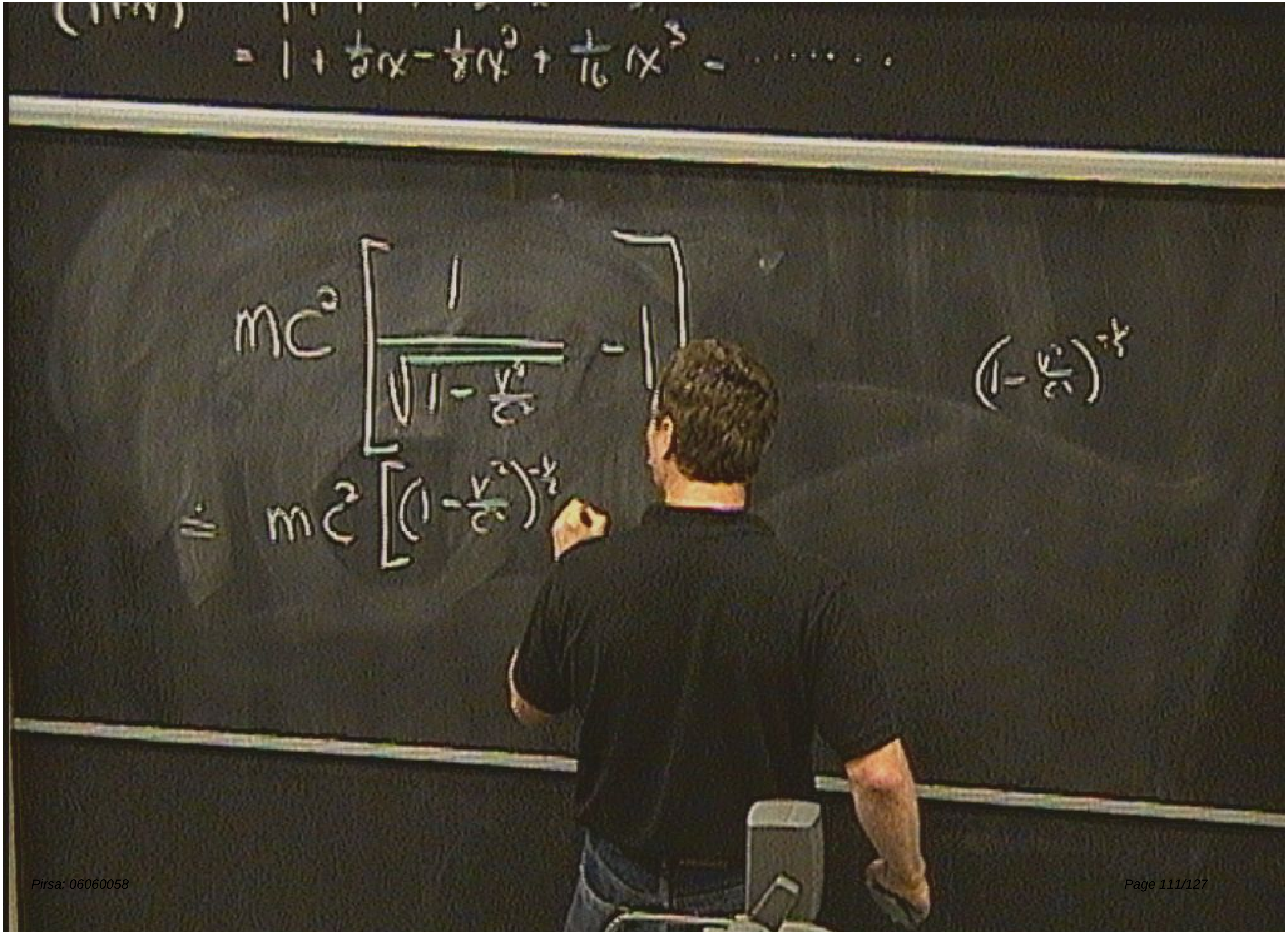
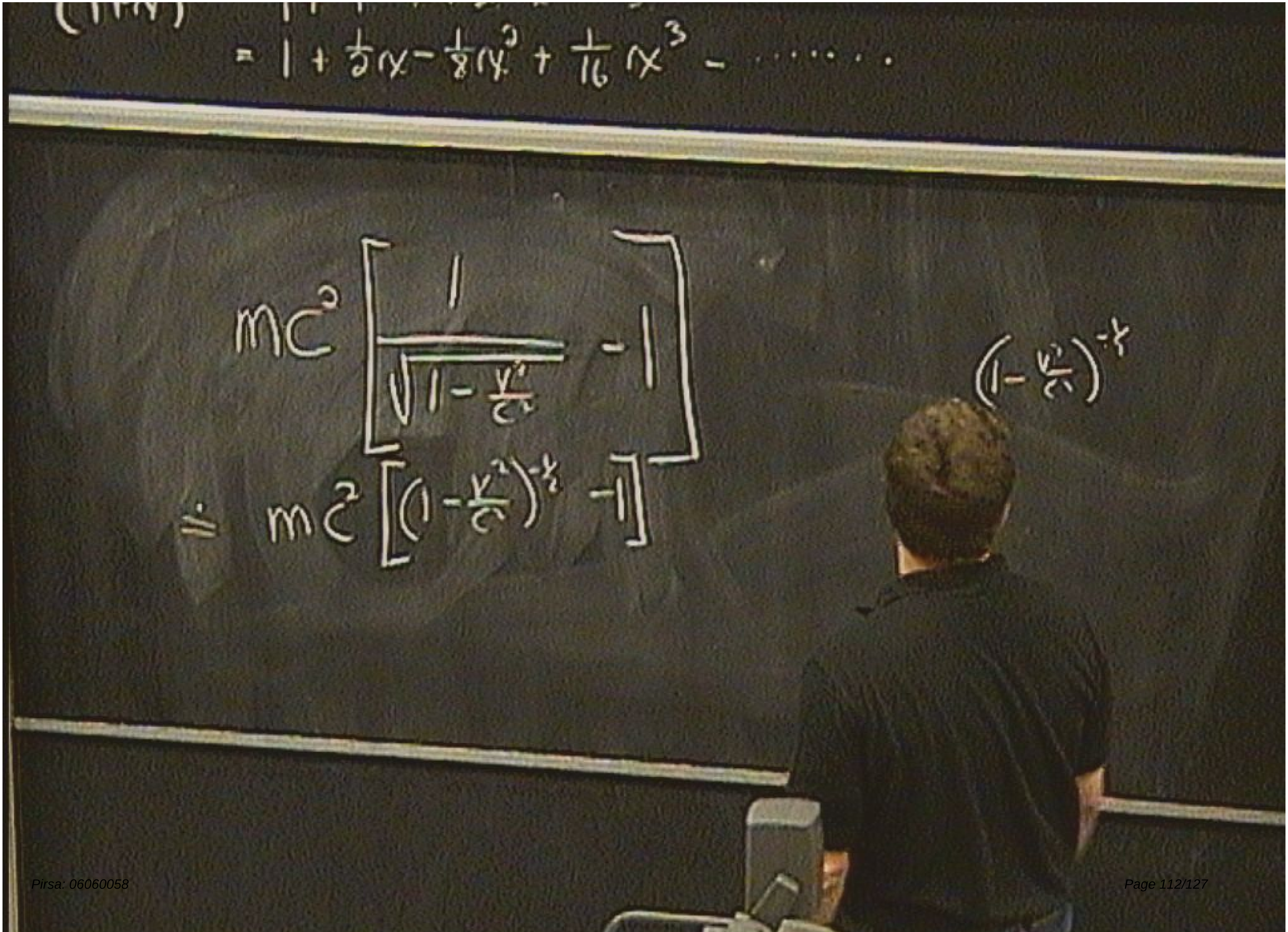
$$mc^2\left[\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1\right]$$

$$\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}}$$



$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \ldots\ldots$
$mc^2\left[\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1\right]$
$\doteq mc^2\left[\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}}\right.$
$\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}}$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$\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}}$

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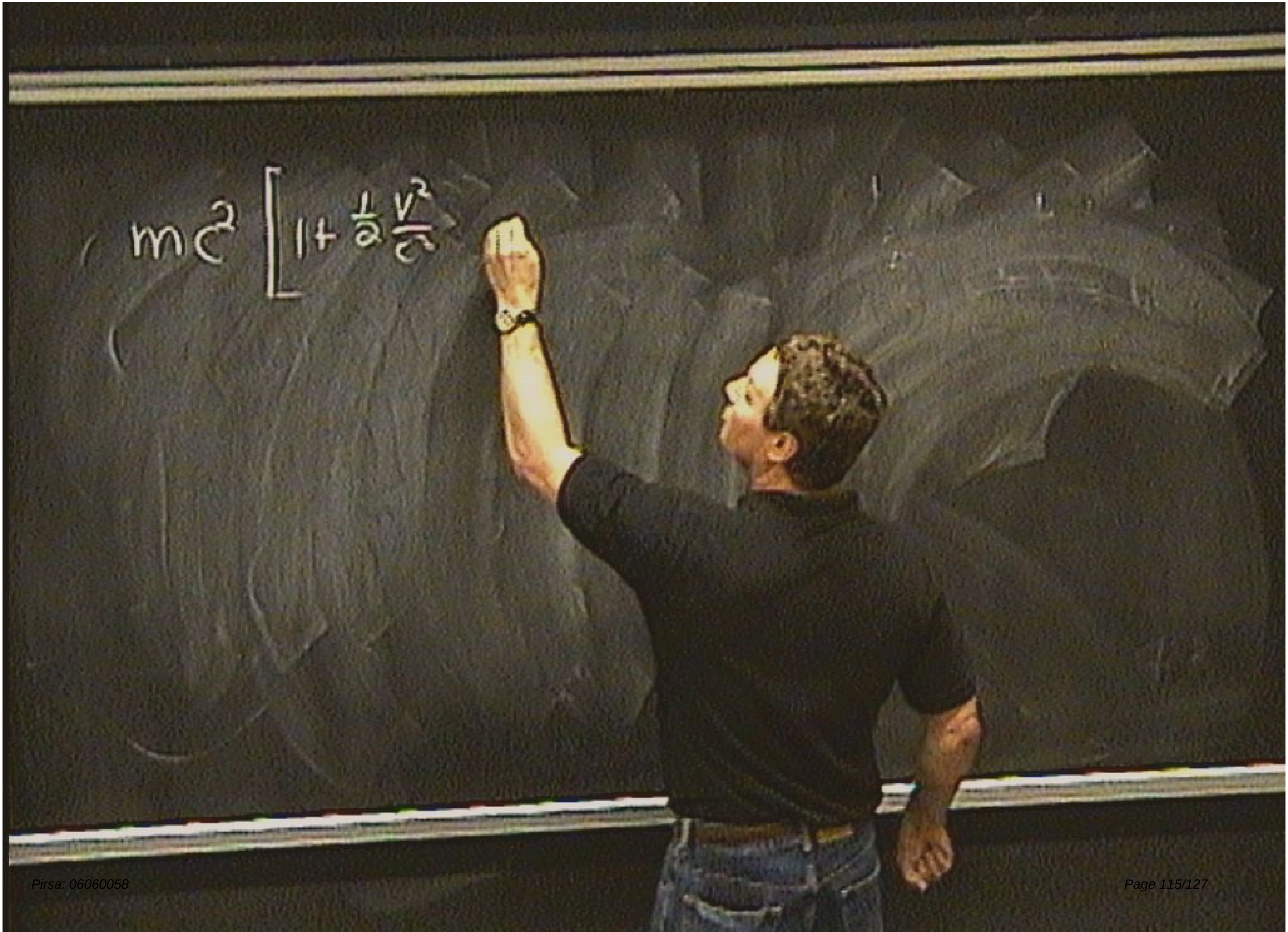
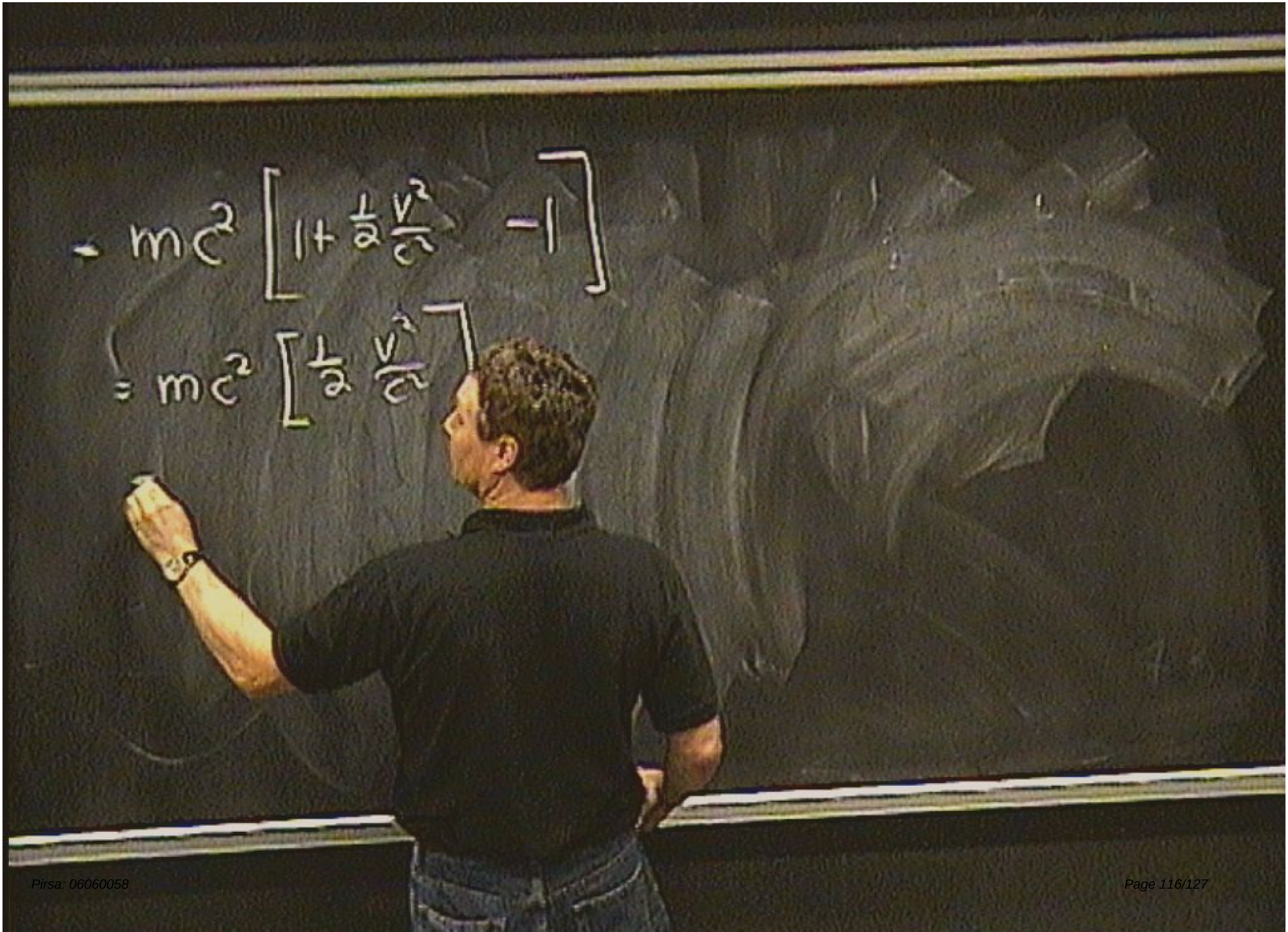
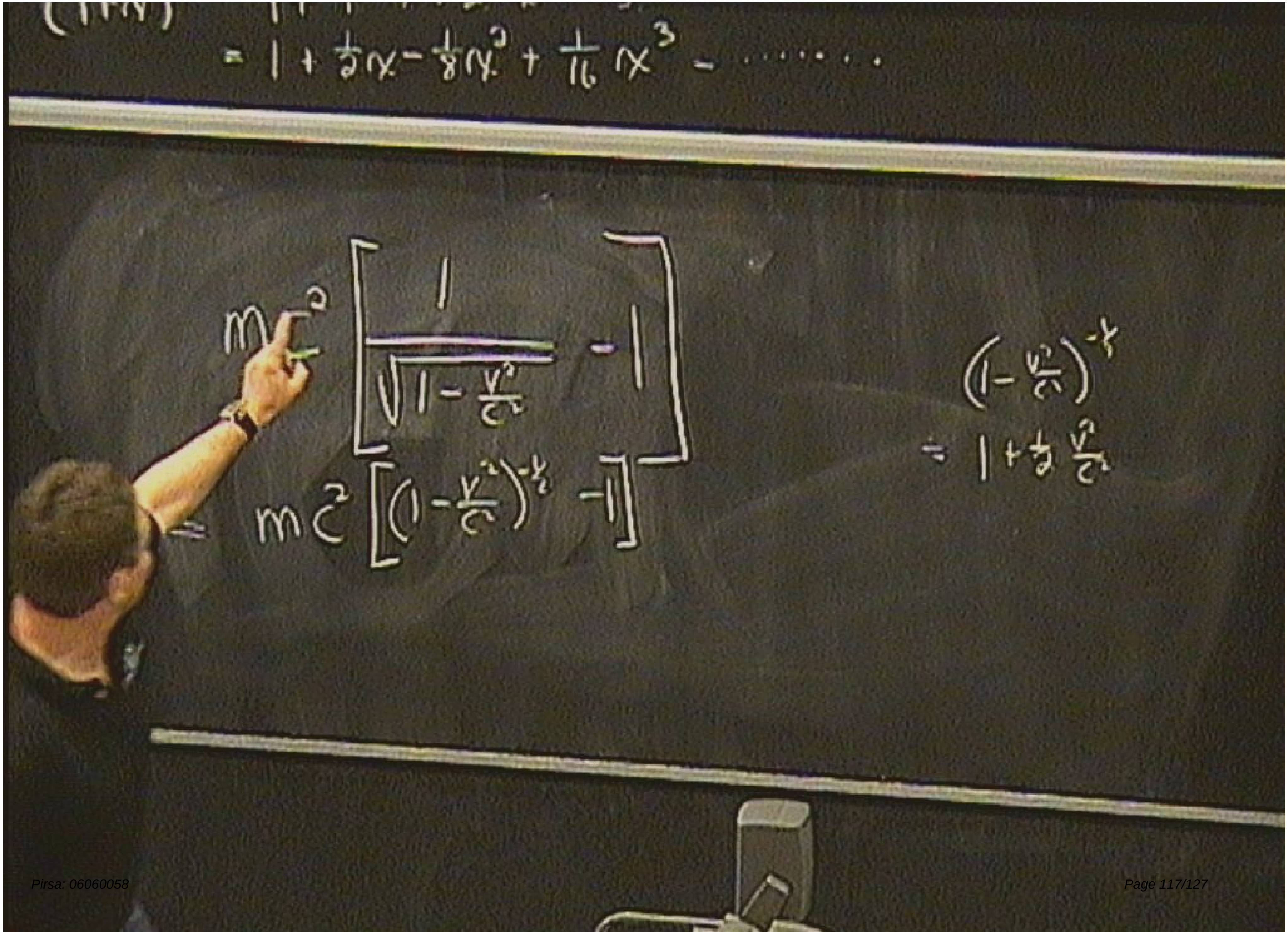
$$\doteq 1 + \frac{1}{2}\frac{v^2}{c^2}$$


$mc^2 \left[1 + \frac{1}{2}\frac{v^2}{c^2} \right.$


$= mc^2 \left[1 + \frac{1}{2}\frac{v^2}{c^2} - 1 \right]$
$= mc^2 \left[\frac{1}{2}\frac{v^2}{c^2} \right]$


$= 1 + \frac{1}{2}x - \frac{1}{8}x^2 + \frac{1}{16}x^3 - \cdots\cdots$
$mc^2\left[\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1\right]$
$= mc^2\left[\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}} - 1\right]$
$\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}}$
$\approx 1 + \frac{1}{2}\frac{v^2}{c^2}$

$$= 1 + \tfrac{1}{2}x - \tfrac{1}{8}x^2 + \tfrac{1}{16}x^3 - \cdots\cdots$$

$$mc^2\left[\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1\right]$$

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$$(a+b)^n = \binom{n}{0} a^n b^0 + \binom{n}{1} a^{n-1} b^1 + \binom{n}{2} a^{n-2} b^2 + \cdots + \binom{n}{r} a^{n-r} b^r + \cdots \binom{n}{n} a^0 b^n$$

$$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$$

$$\frac{k}{r^2}$$

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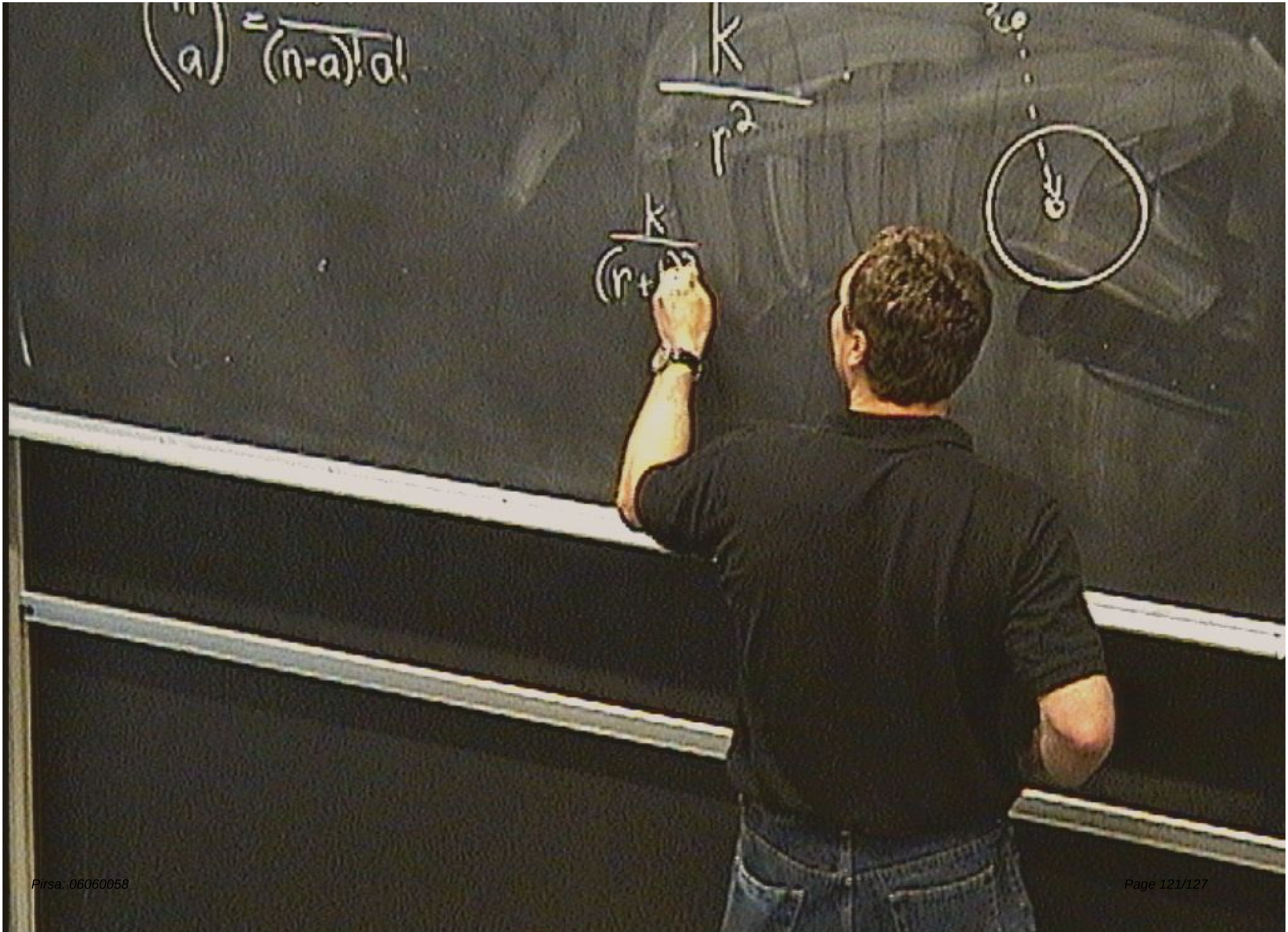
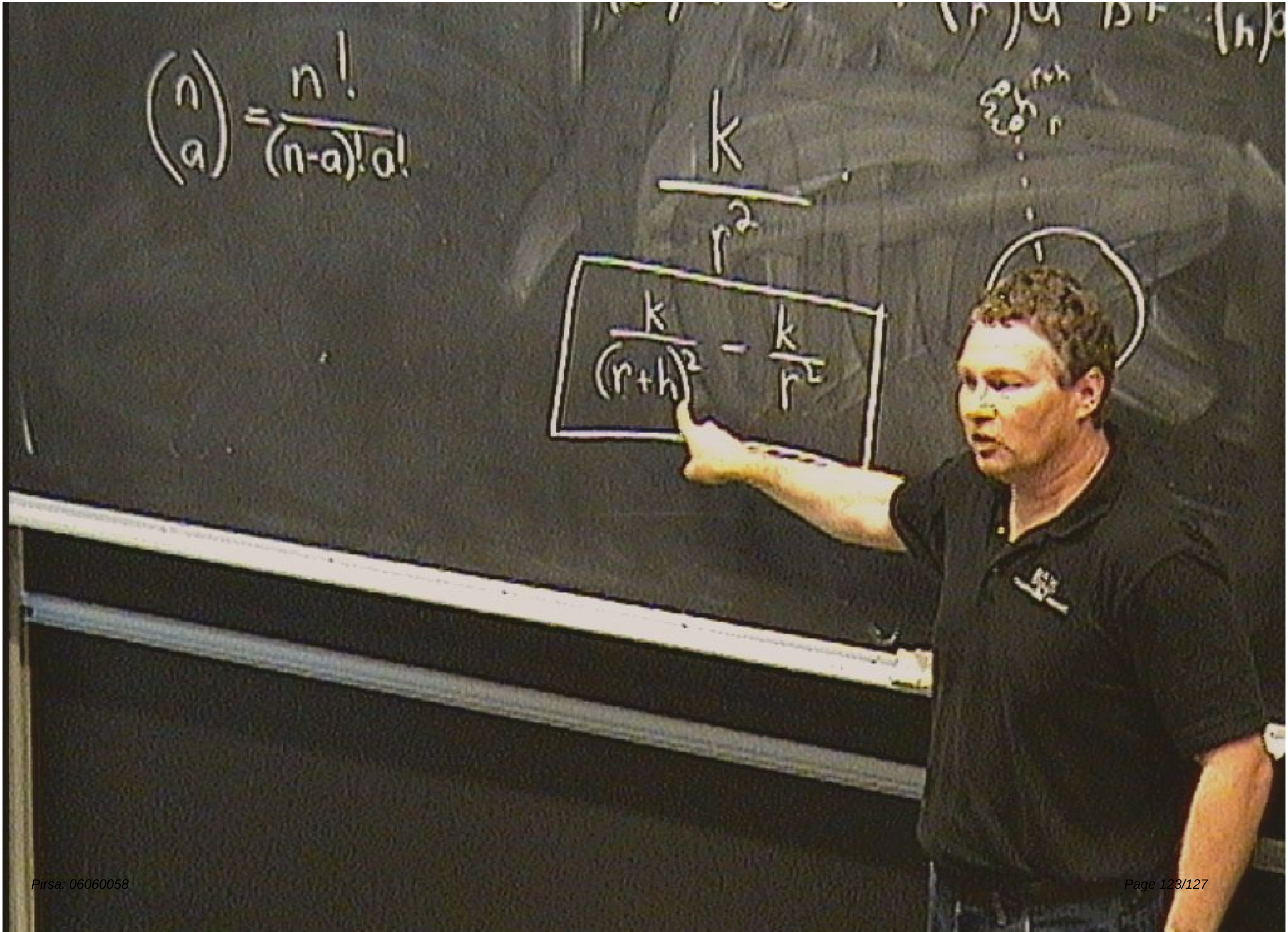


(n-a)!a!
k
r²
k
(r+

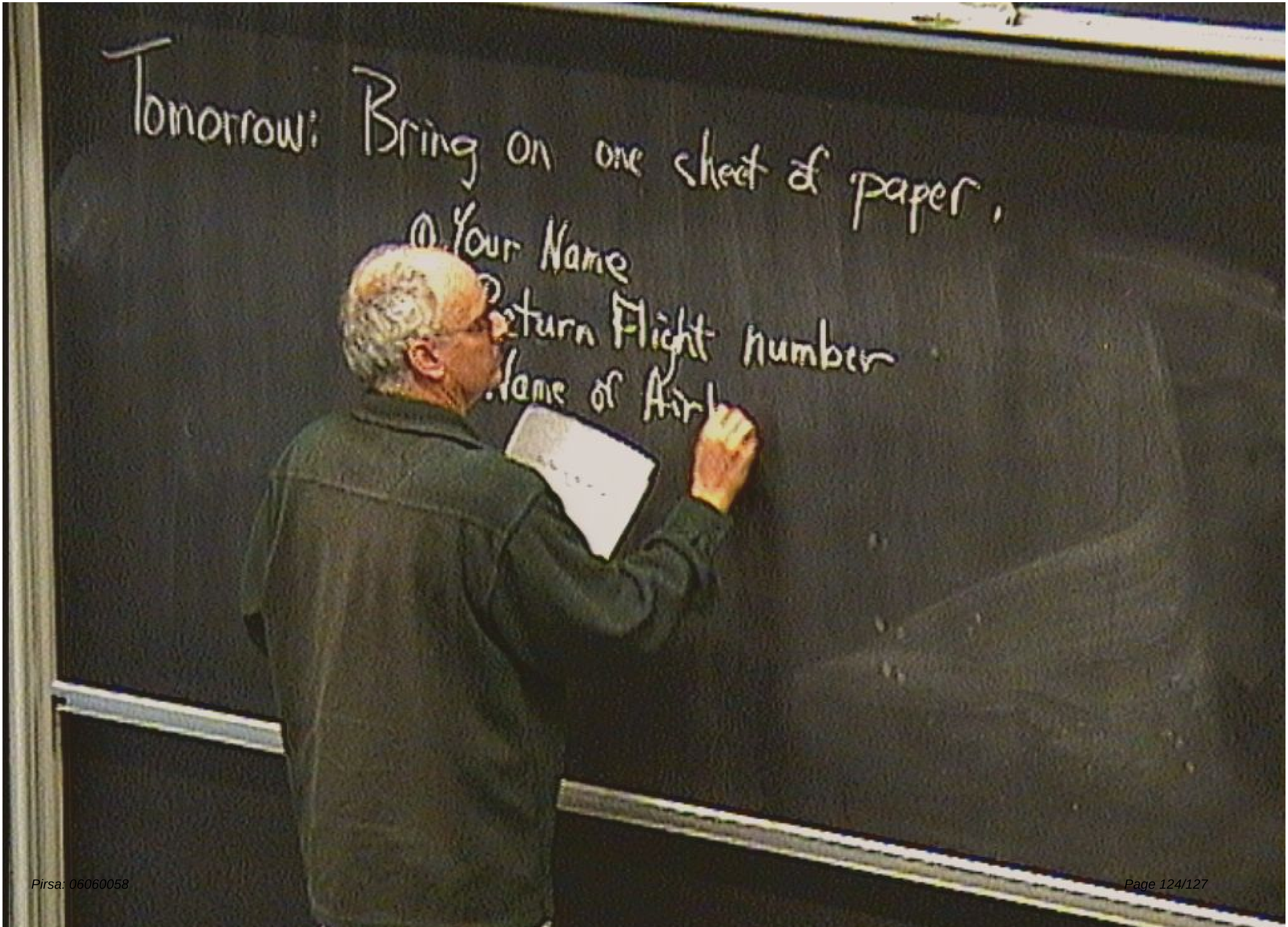
$$\binom{n}{a} = \frac{n!}{(n-a)!\,a!}$$

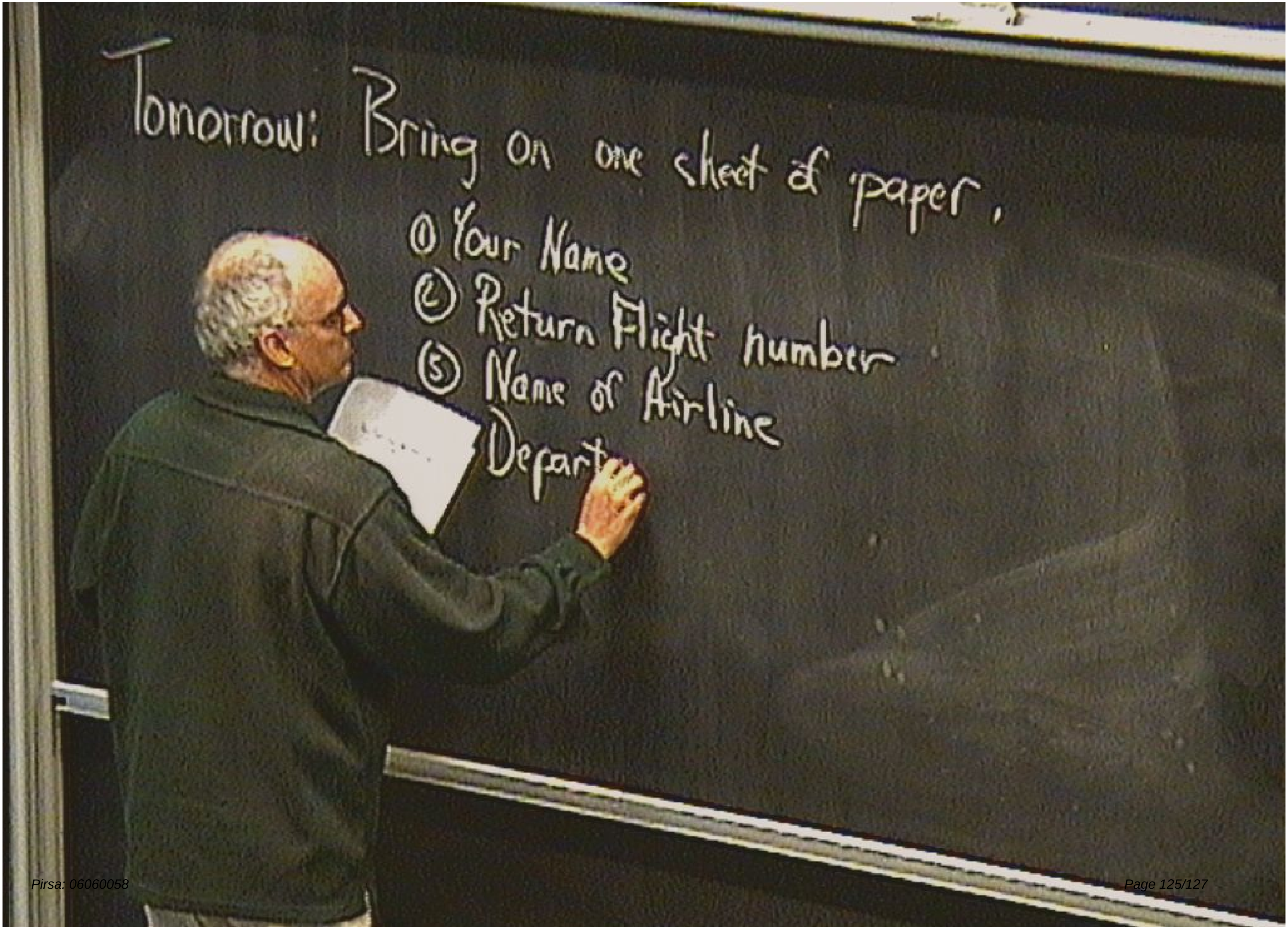
$$\frac{k}{r^2}$$

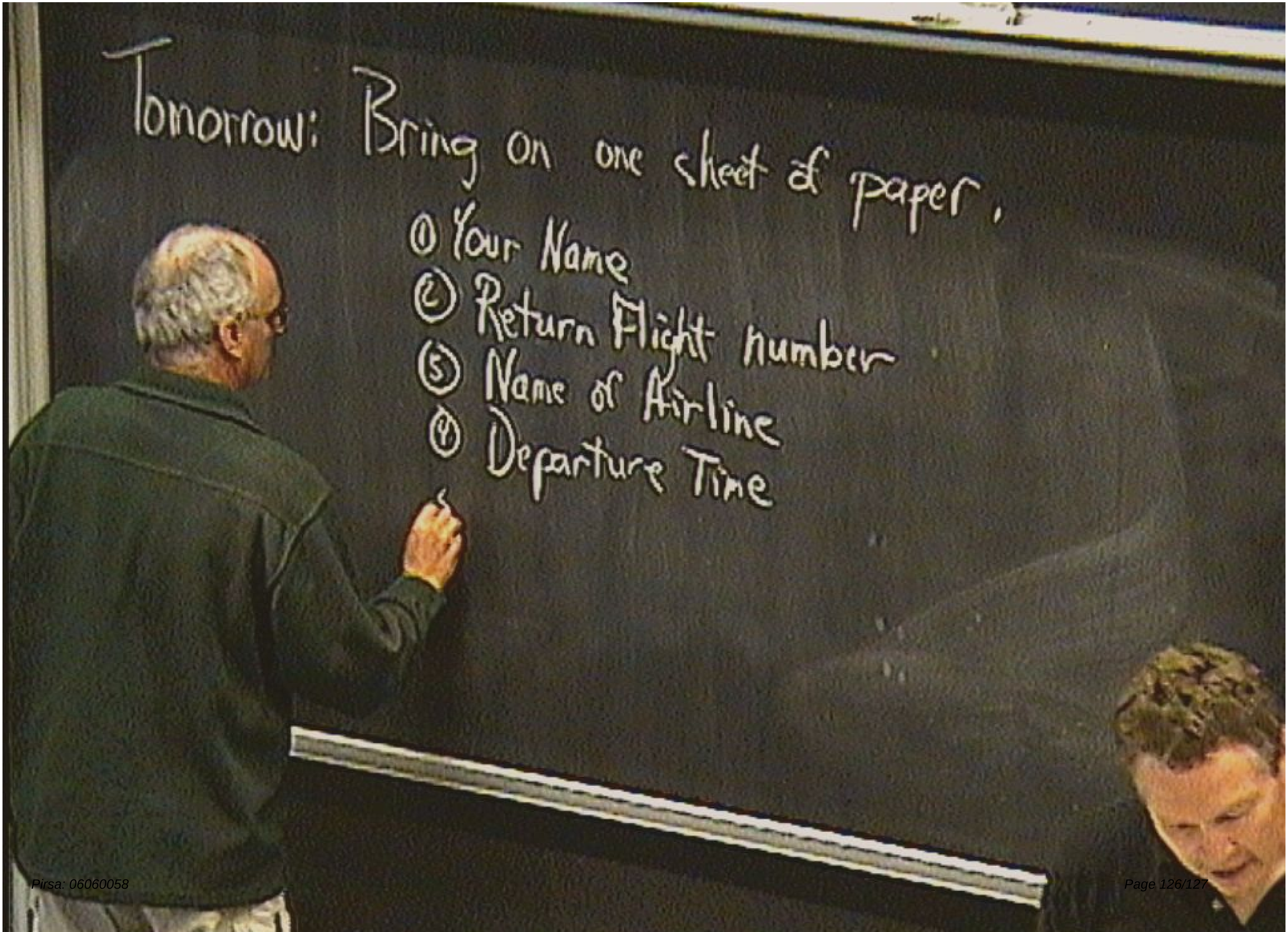
$$\frac{k}{(r+h)^2} - \frac{k}{r^2}$$



(n a) = n! / (n-a)! a!
k / r²
k / (r+h)² - k / r²


Tomorrow: Bring on one sheet of paper.
Your Name
Flight number


Tomorrow: Bring on one sheet of paper.
1 Your Name
2 Return Flight number
3 Name of Airline
Depart


Tomorrow: Bring on one sheet of paper.
1 Your Name
2 Return Flight number
3 Name of Airline
4 Departure Time

Tomorrow: Bring on one sheet of paper.

1. Your Name
2. Return Flight number
3. Name of Airline
4. Departure Time
5. Terminal