

Physics Fun Facts of the Day

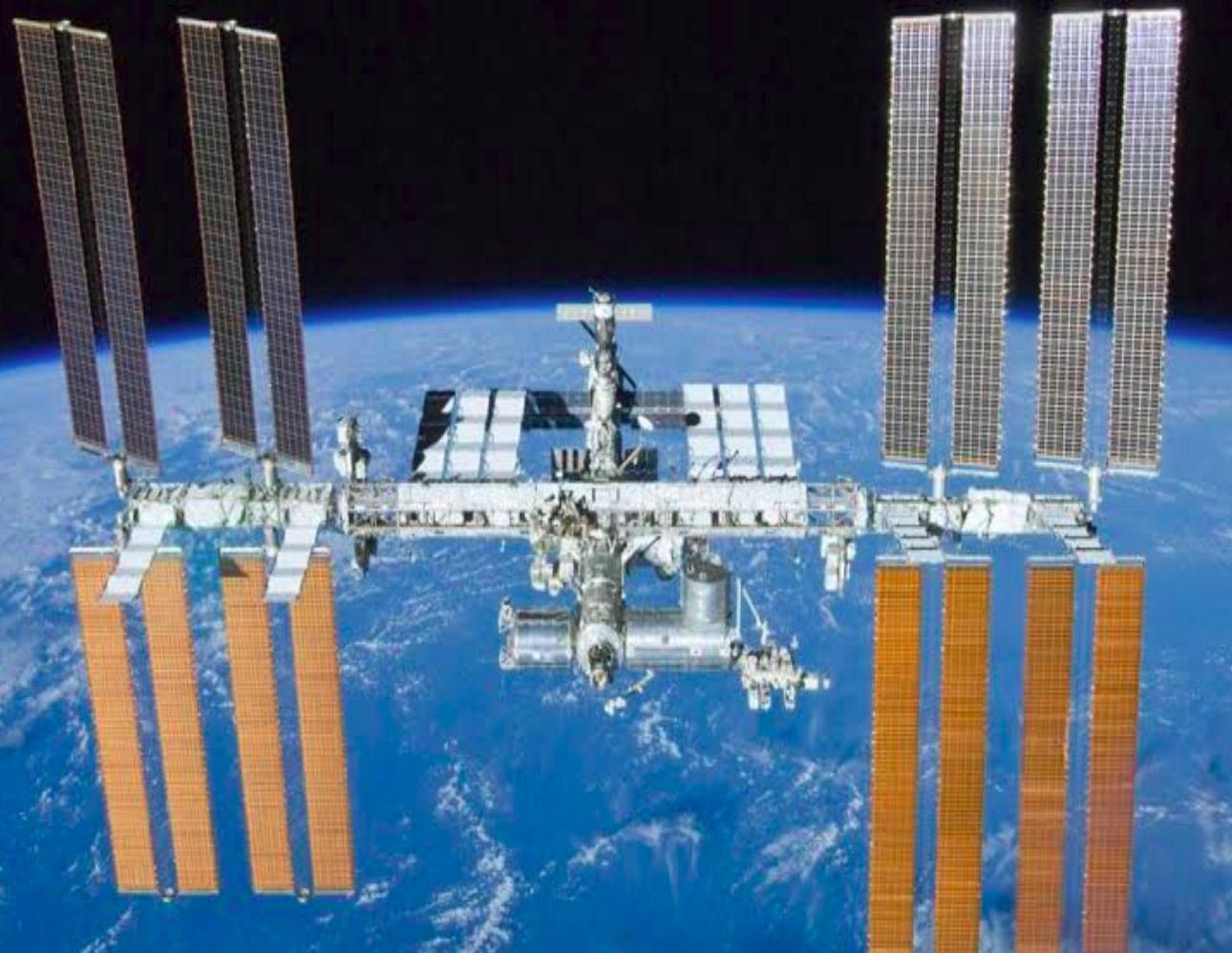
Mwl. Gibson

Physics Fact of the Day

Gravity makes you strong!

“For every action, there is an equal and opposite reaction.”

To stand, you provide a force equal and opposite to gravity.
→ This makes our bones and muscles stronger



6/7 Days, astronauts need to work out for ~2.5 hours

If they do not, they may return to earth and not be able to stand.

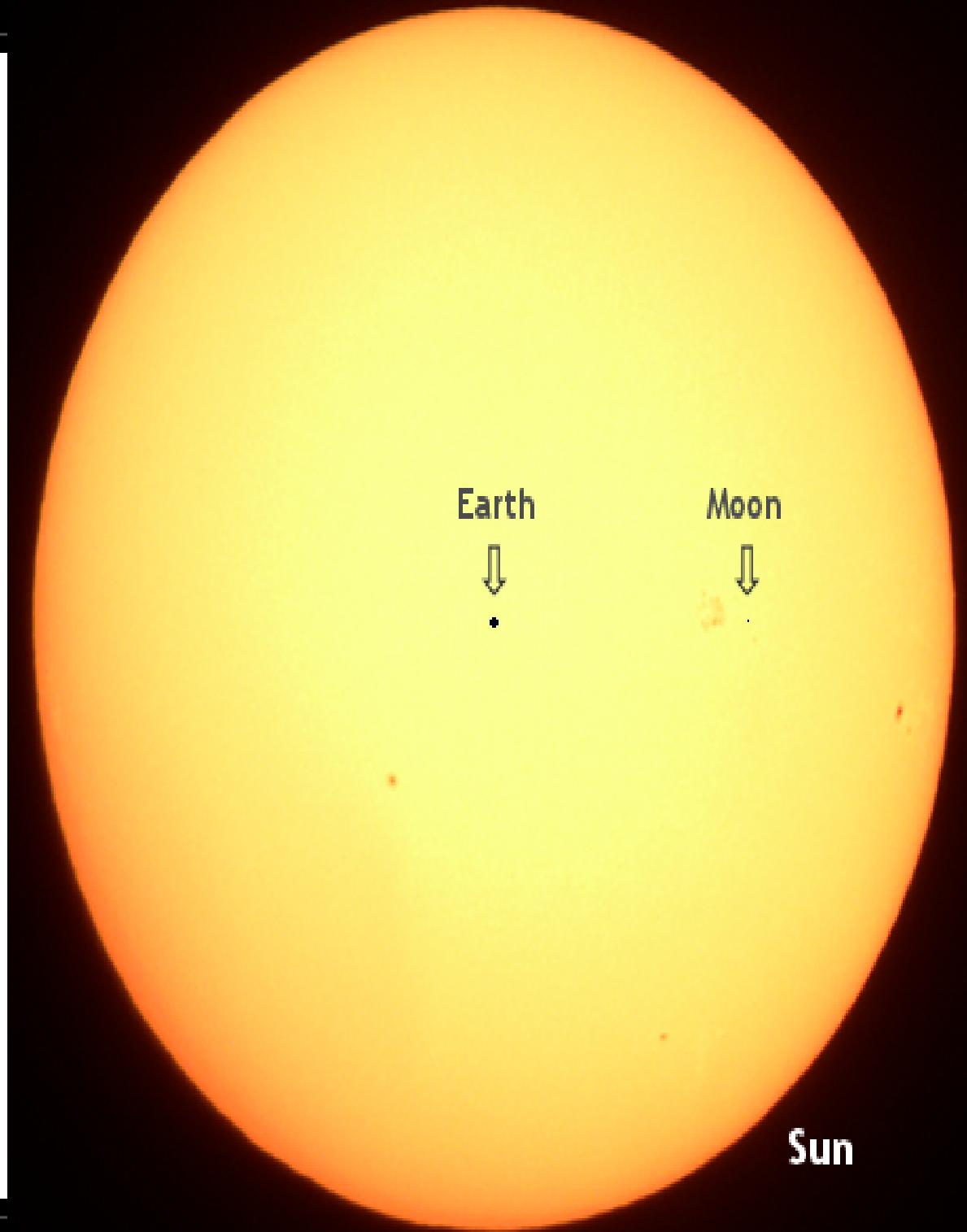
Physics Fun Facts of the Day

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Today's Physics Fact of the Day

Space is big and empty





What size is earth?

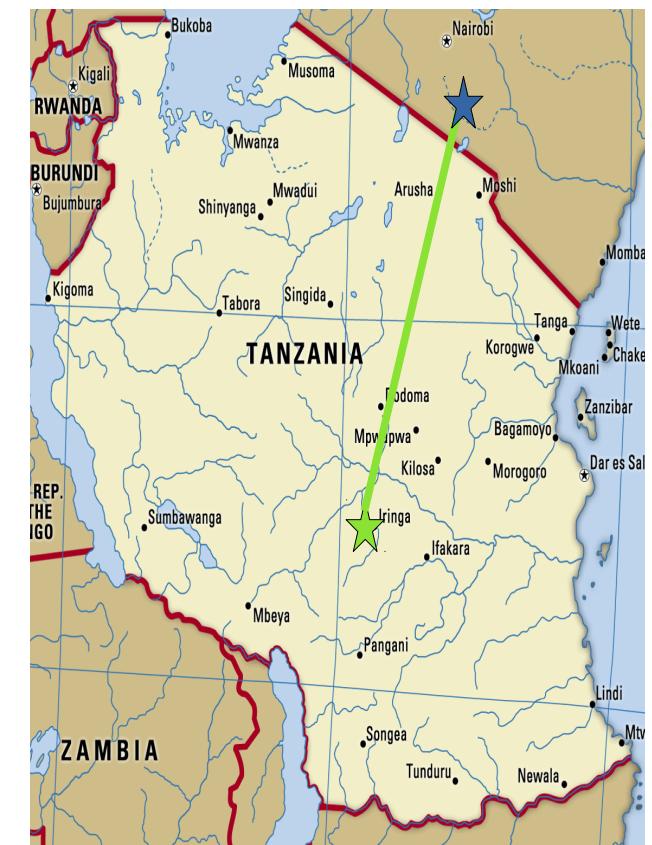
Smaller than a grain of sand!

If this is our sun:



Where is the next closest star?

≈745 kilometers



Physics Fun Facts of the Day

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Physics Fun Fact of the Day

Floating

Why do people appear to float when they jump?

Kinematics! (Mechanics)

The Kinematic Equations

$$d = v_i * t + \frac{1}{2} * a * t^2 \quad v_f^2 = v_i^2 + 2 * a * d$$

$$v_f = v_i + a * t \quad d = \frac{v_i + v_f}{2} * t$$



Floating



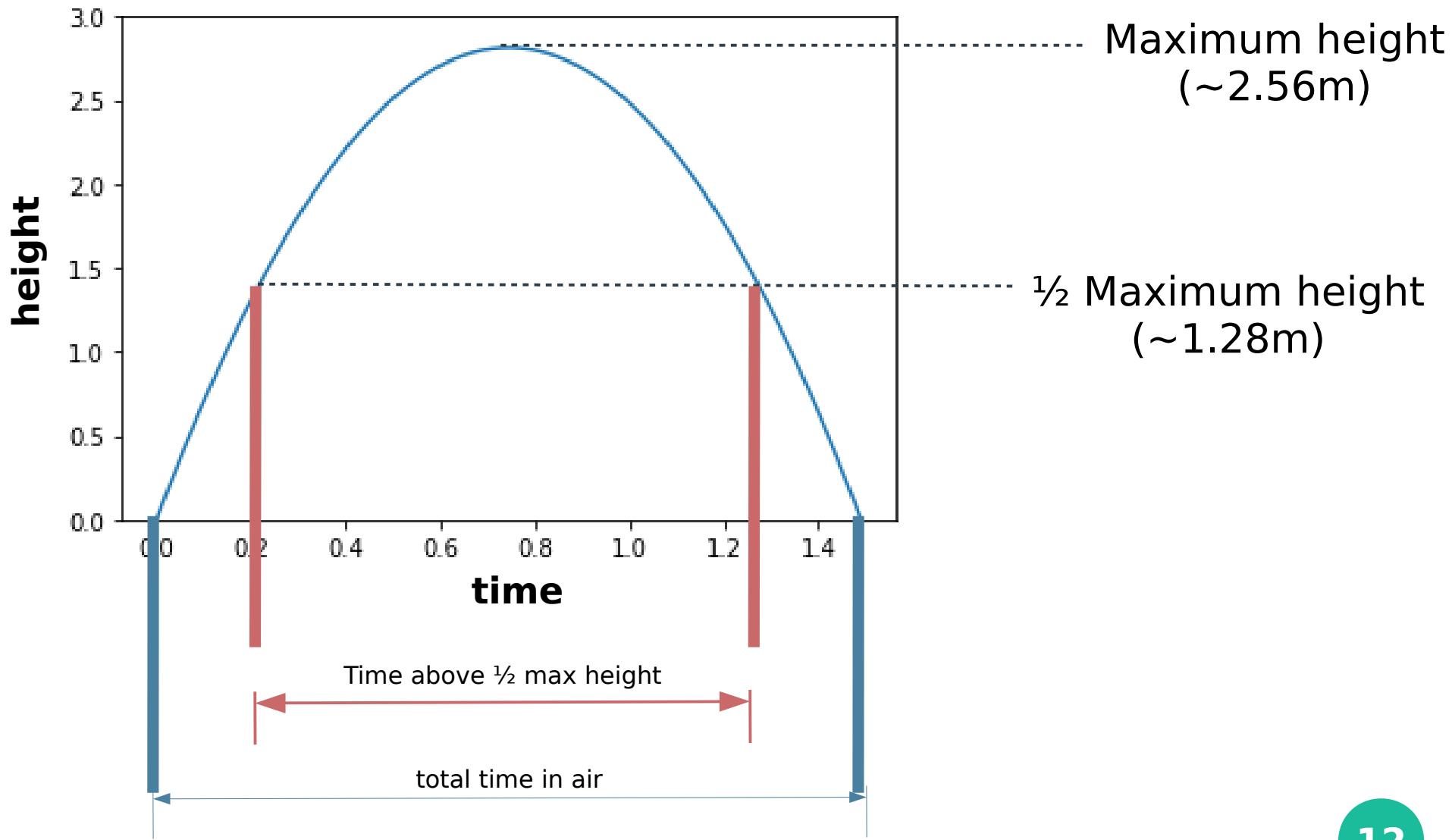
Floating

Cristiano Ronaldo Jumped An Incredible **2.56** Meters And Got **1.5 Seconds** Airtime

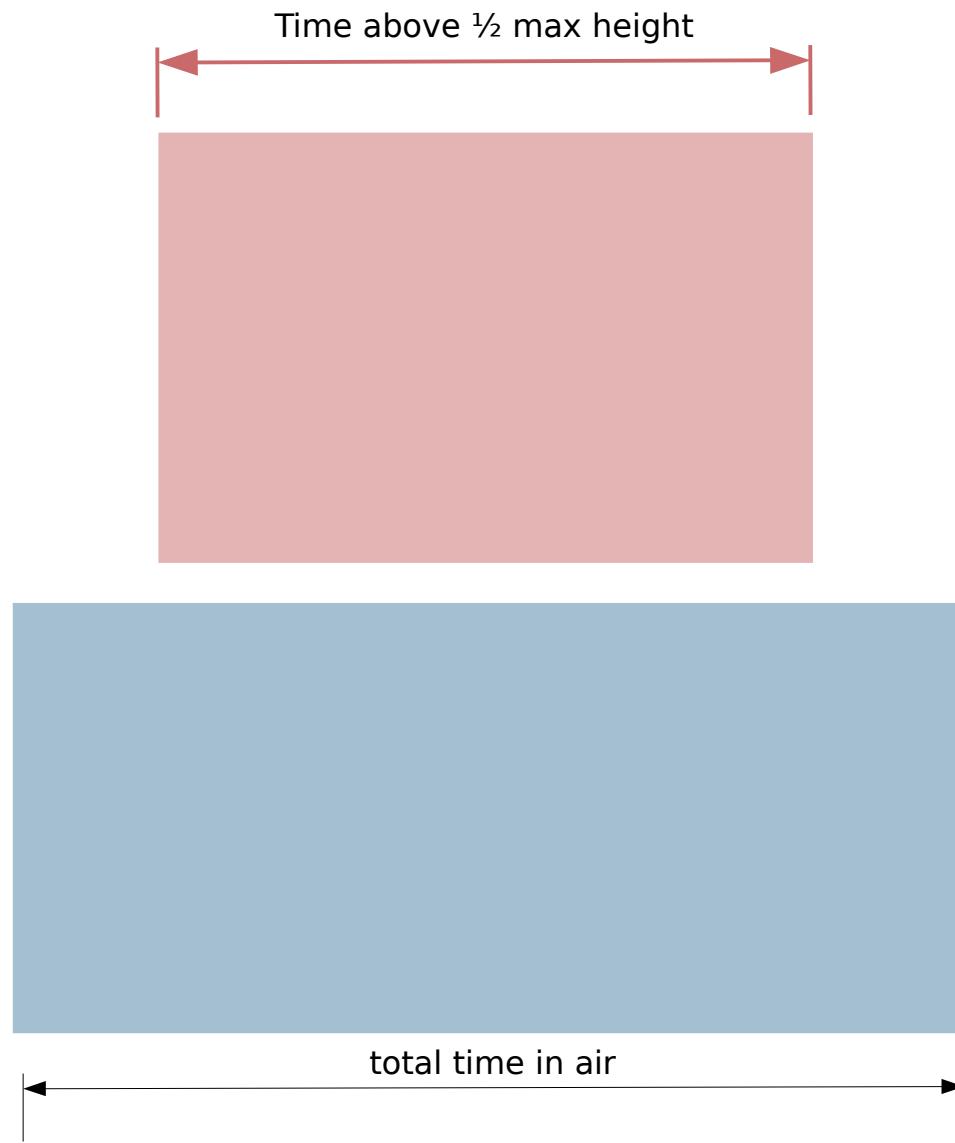
$$a_{\text{gravity}} = 9.8 \text{ m/s}^2$$



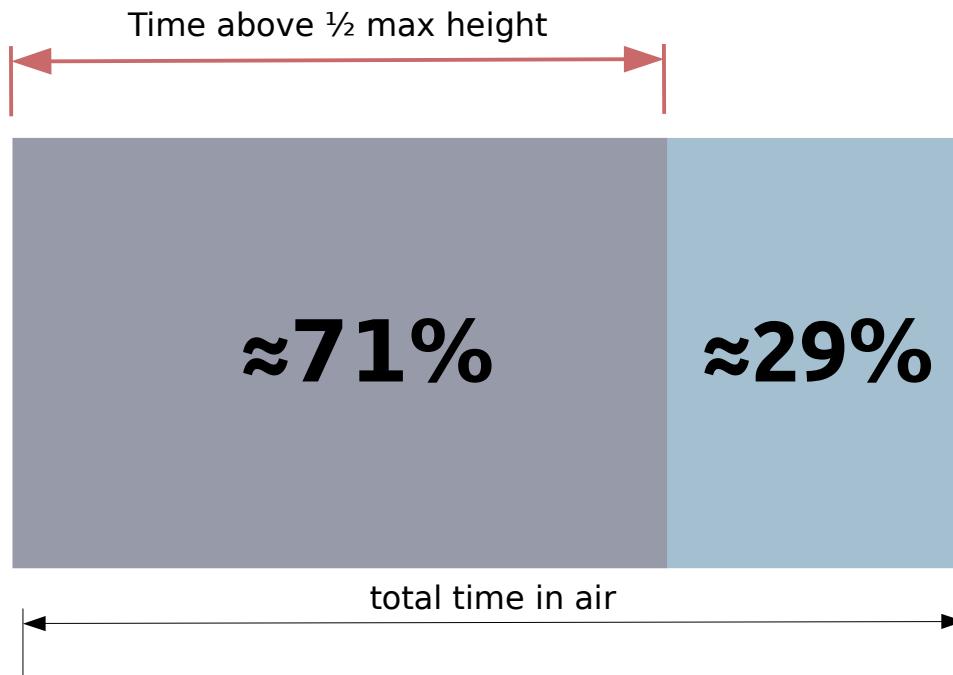
Floating



Floating

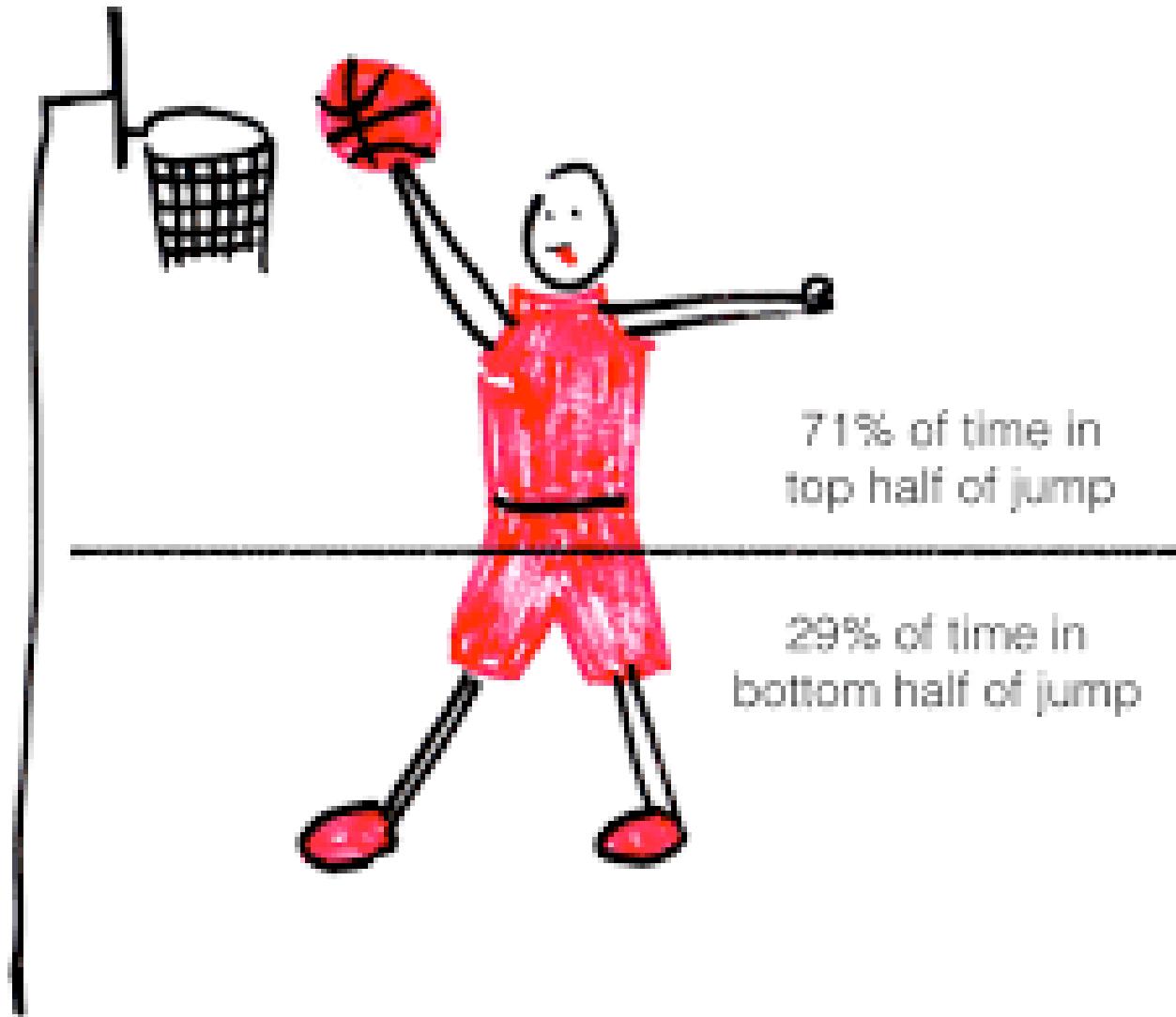


Floating

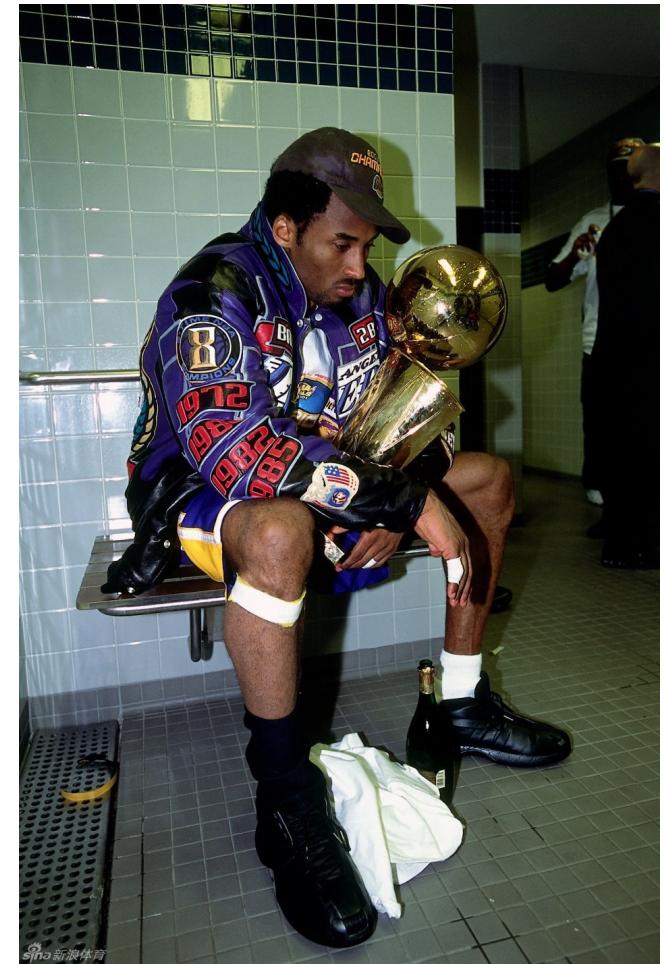
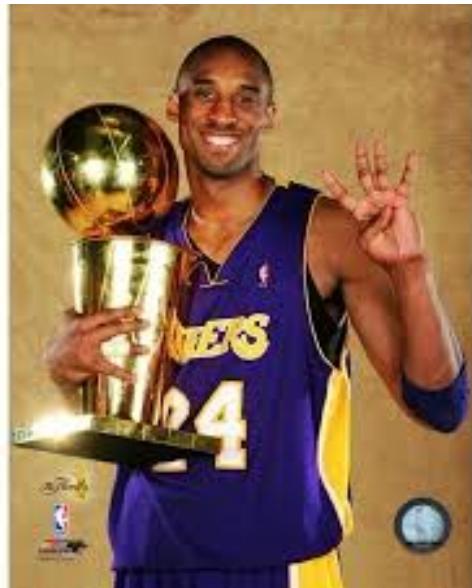
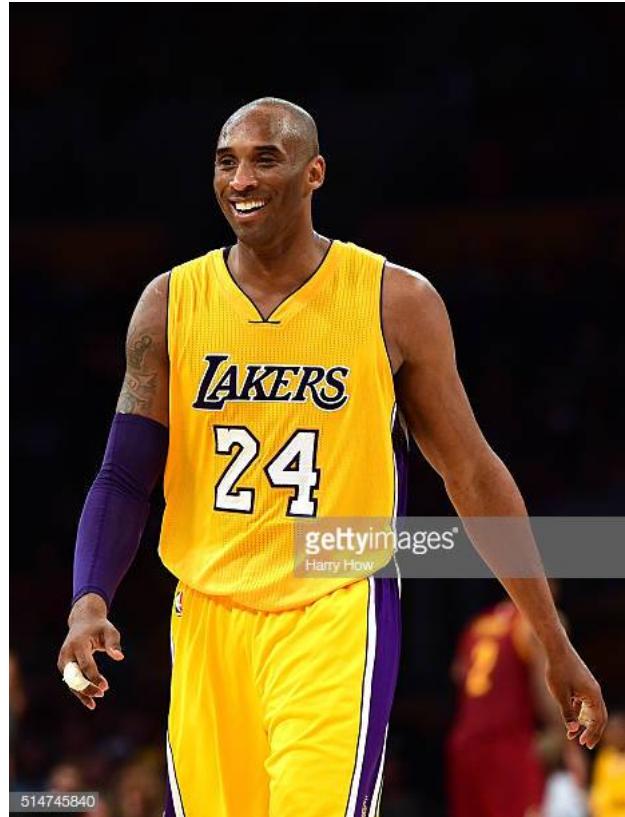


When a person jumps, he/she spends $\approx 71\%$ of the time above $\frac{1}{2}$ of max height

Floating

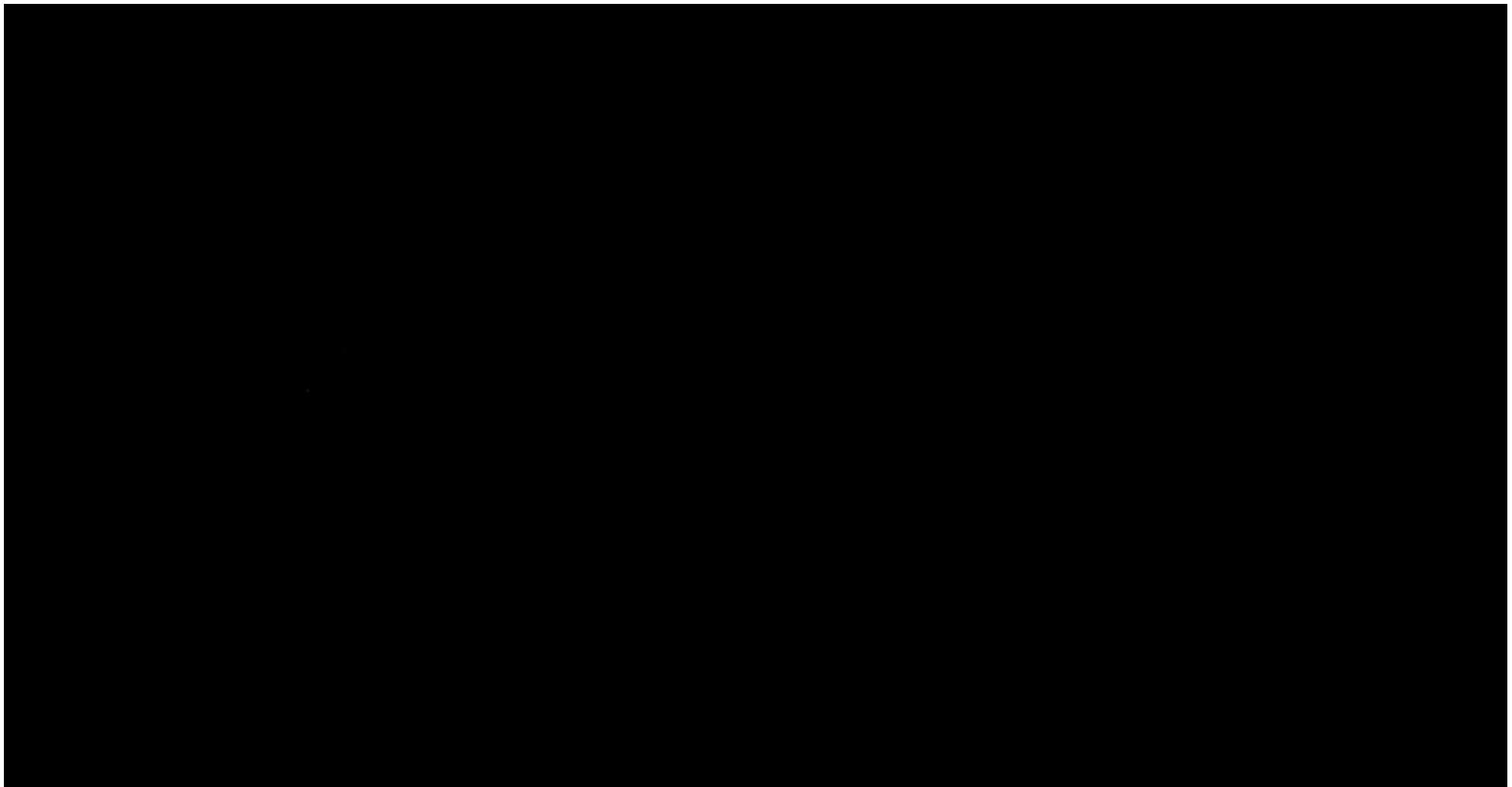


Kobe Bryant (1978-2020)



KOBE
JUMPS OVER
CAR SLOW
MOTION

R.I.P. Kobe Bryant (1978-2020)



Physics Fun Facts of the Day

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Announcements

Computer Programming Club will meet again tomorrow (Wednesday) at 8:00pm

Topics include:

- Storing data
- Strings, Floats, Integers
- Operators
- Printing
- User input / generated output

Physics Fun Fact of the Day

Water vs. Land: Grenades and Guns

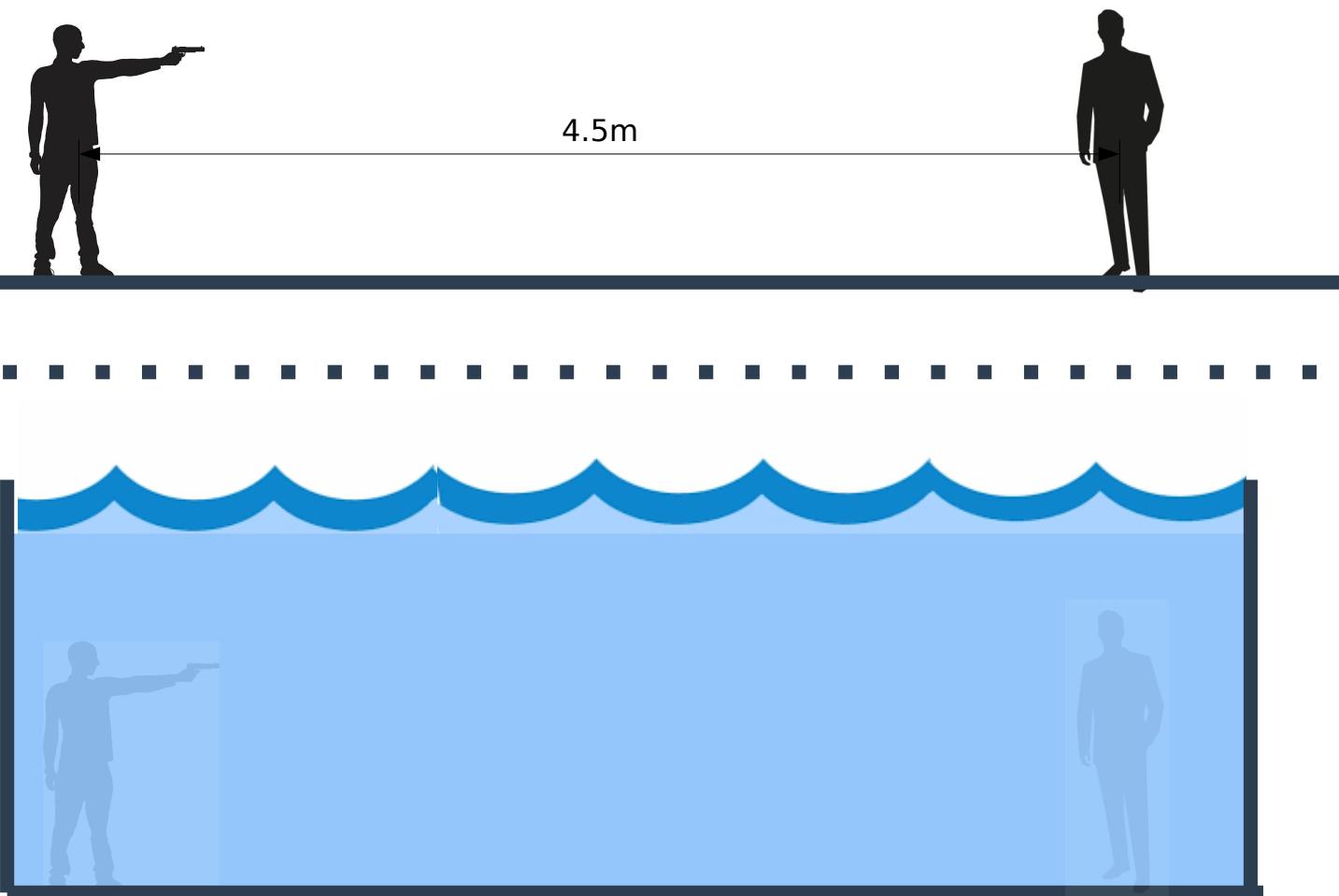
Grenades



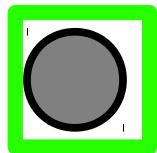
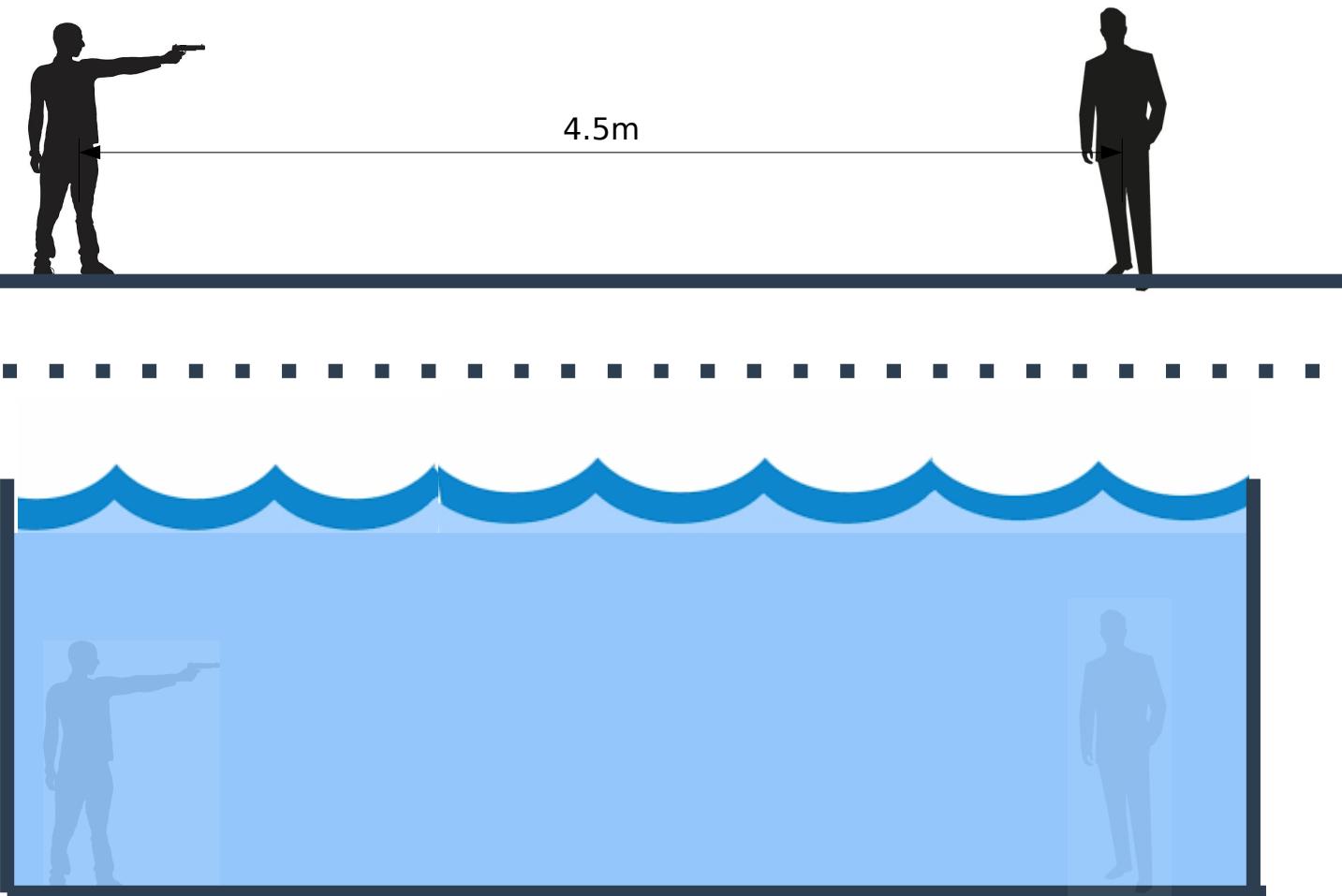
Guns



Which is better?



Which is better?



Drag Force (resistive force)

Constant (experimentally determined)

$$F_{drag} = C_D A \frac{\rho V^2}{2}$$

Diagram illustrating the components of the drag force equation:

- A downward arrow points to the term ρ (Density of surroundings).
- An upward arrow points to the term A (Area).
- A horizontal arrow points to the term V^2 (Velocity).

Drag Force is proportional to density

$$\rho_{water} = 1,000 \frac{kg}{m^3}$$

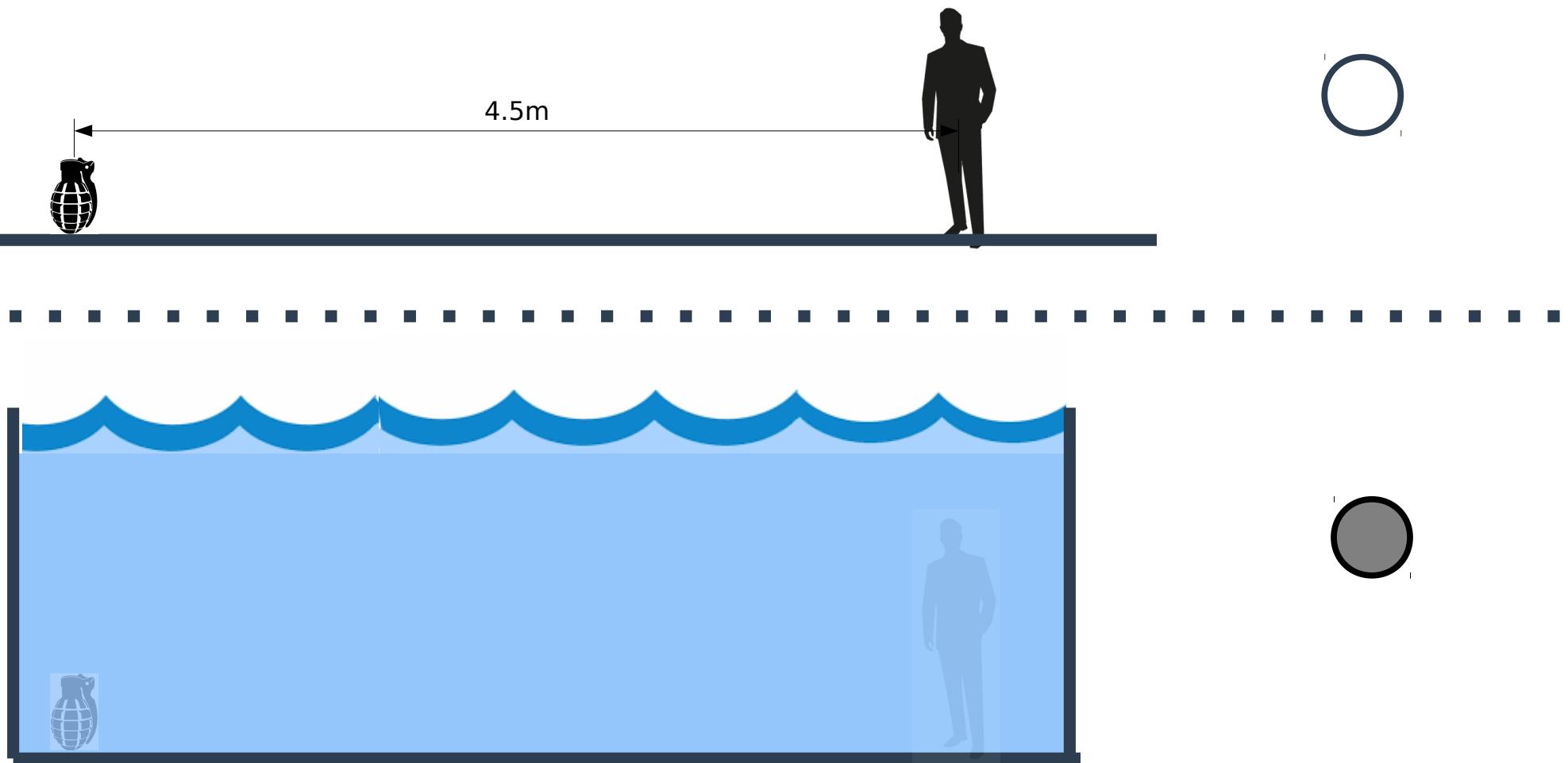
$$\rho_{air} = 1 \frac{kg}{m^3}$$

Water has a drag force 1,000 times the drag force of air!

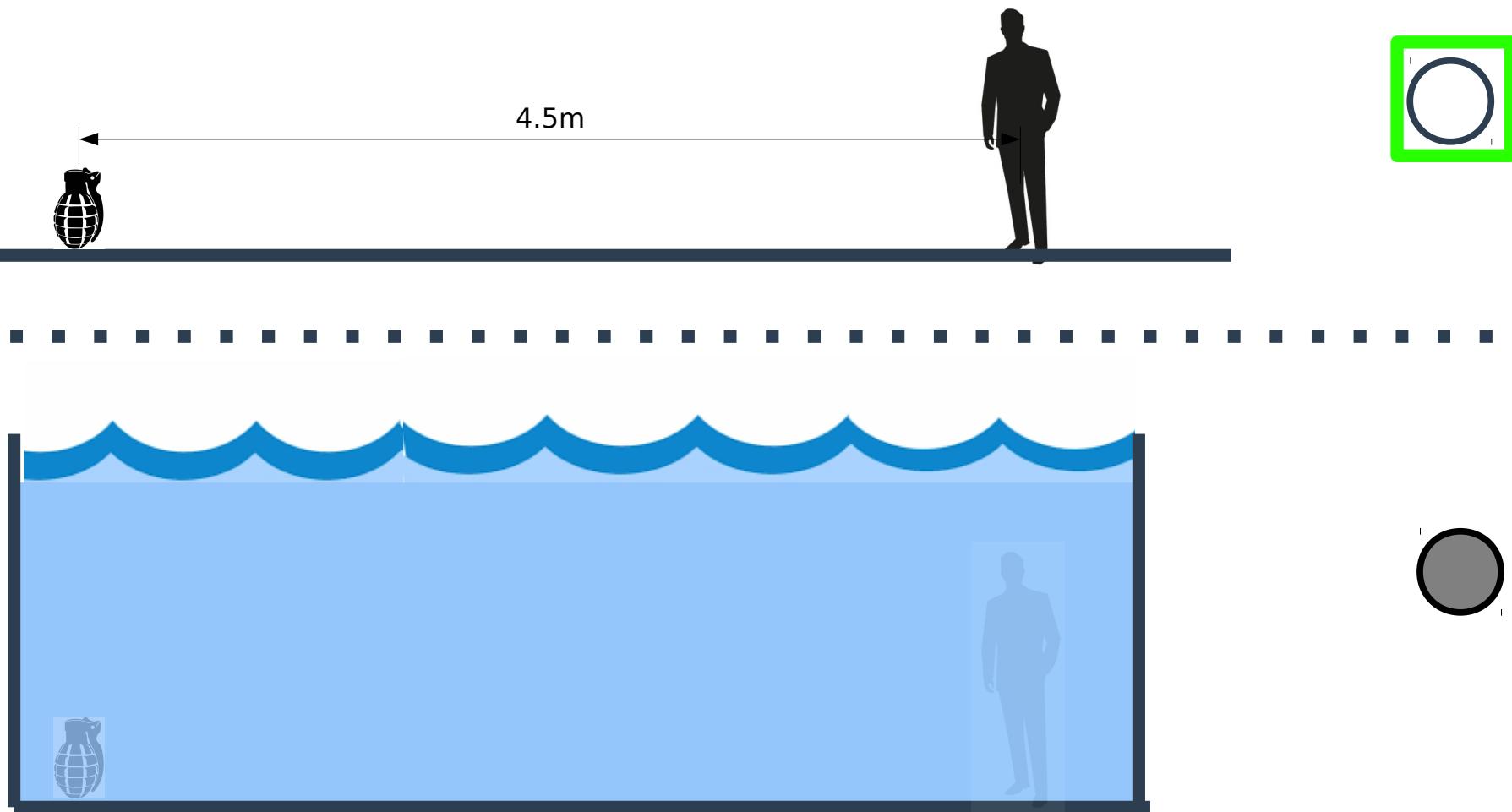
Water Drag

Play Video 1

Which is better?



Which is better?



Conservation of Momentum

For Explosions:



In Water

- Nearly all momentum is conserved
- Momentum/Energy is released when explosion reaches air

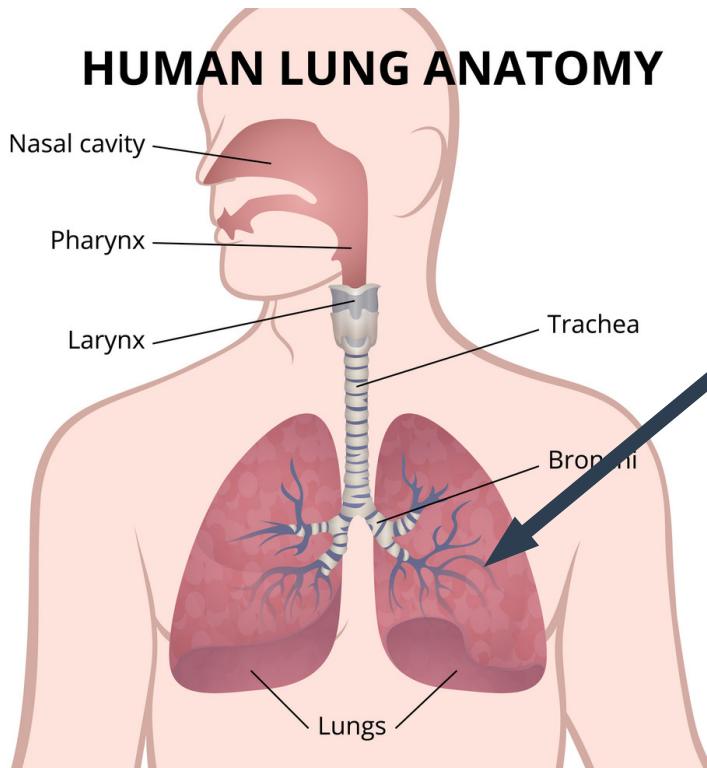
In Air

- Momentum is quickly lost in air

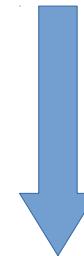
Conservation of Momentum

In Water

Momentum/Energy is released when explosion reaches air



Lungs are part air



**Grenade in water
would destroy your
lungs**

Water Conservation of Momentum

Play Video 2

Water Conservation of Momentum

If someone has a gun → Safe to hide under water

If someone has a grenade → Run Away and fall down
Do not hide under water

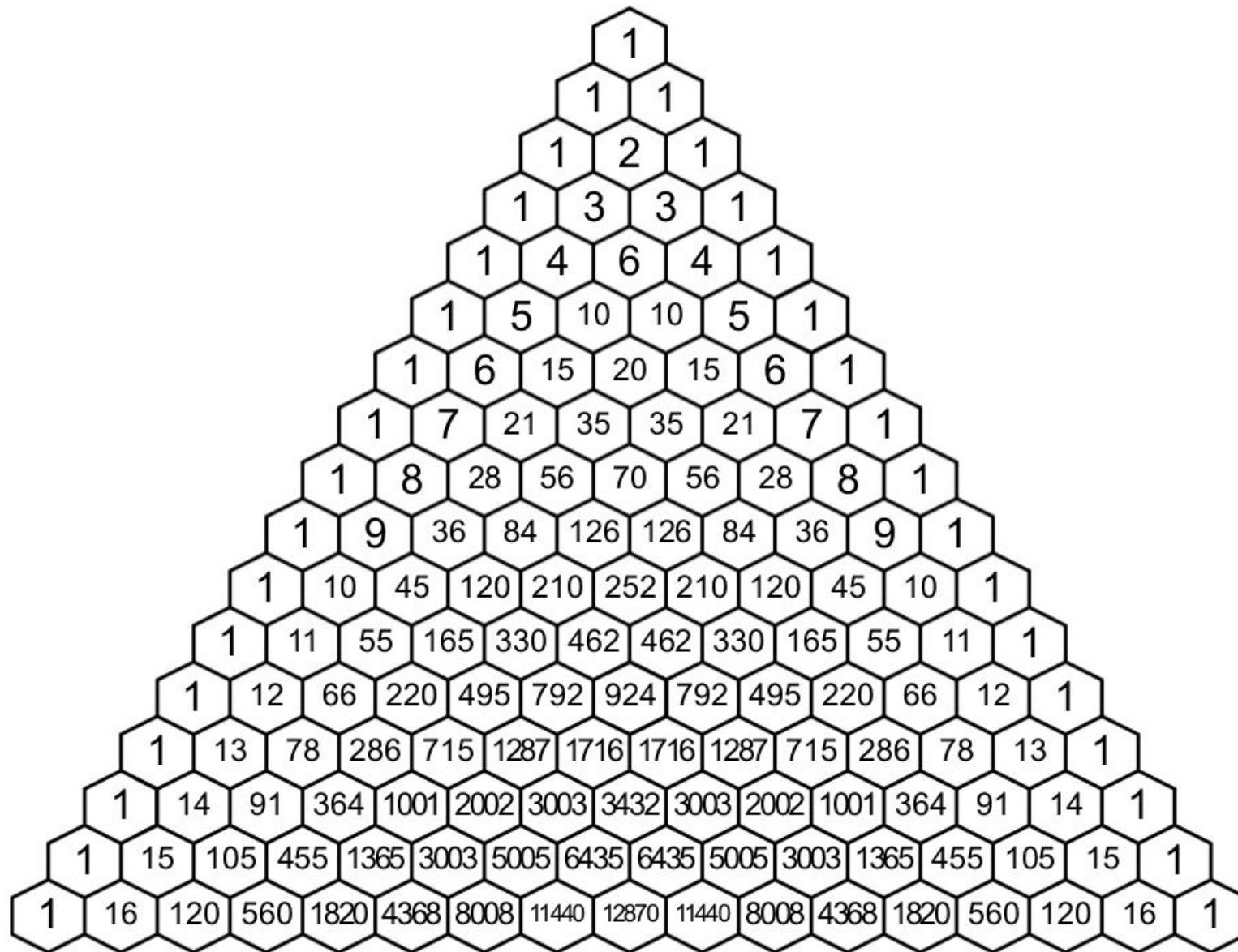
The coolest math thing that you will ever learn

(Part 1/4)

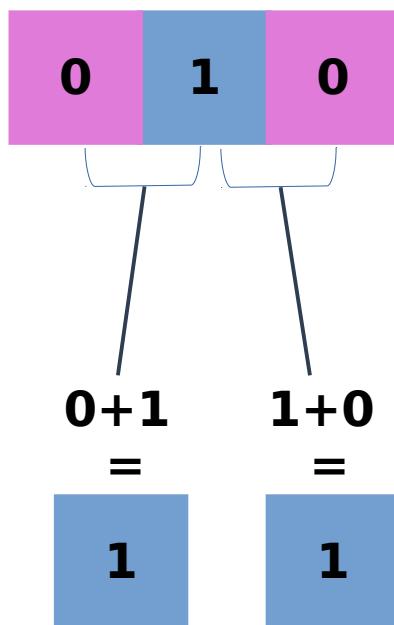
(helpful to physics)

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Pascal's Triangle

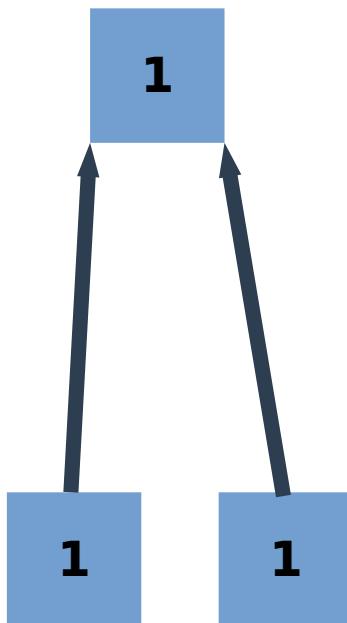


How to create



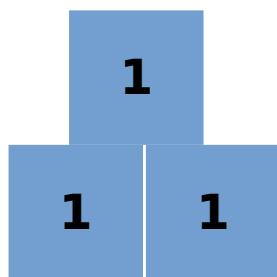
1. Start with a 1
2. Add zero to left and right ends
(not part of the triangle)
3. Take the sum of adjacent boxes

How to create



1. Start with a 1
2. Add zero to left and right ends (not part of the triangle)
3. Take the sum of adjacent boxes
4. Using the sums, make a new row below

How to create



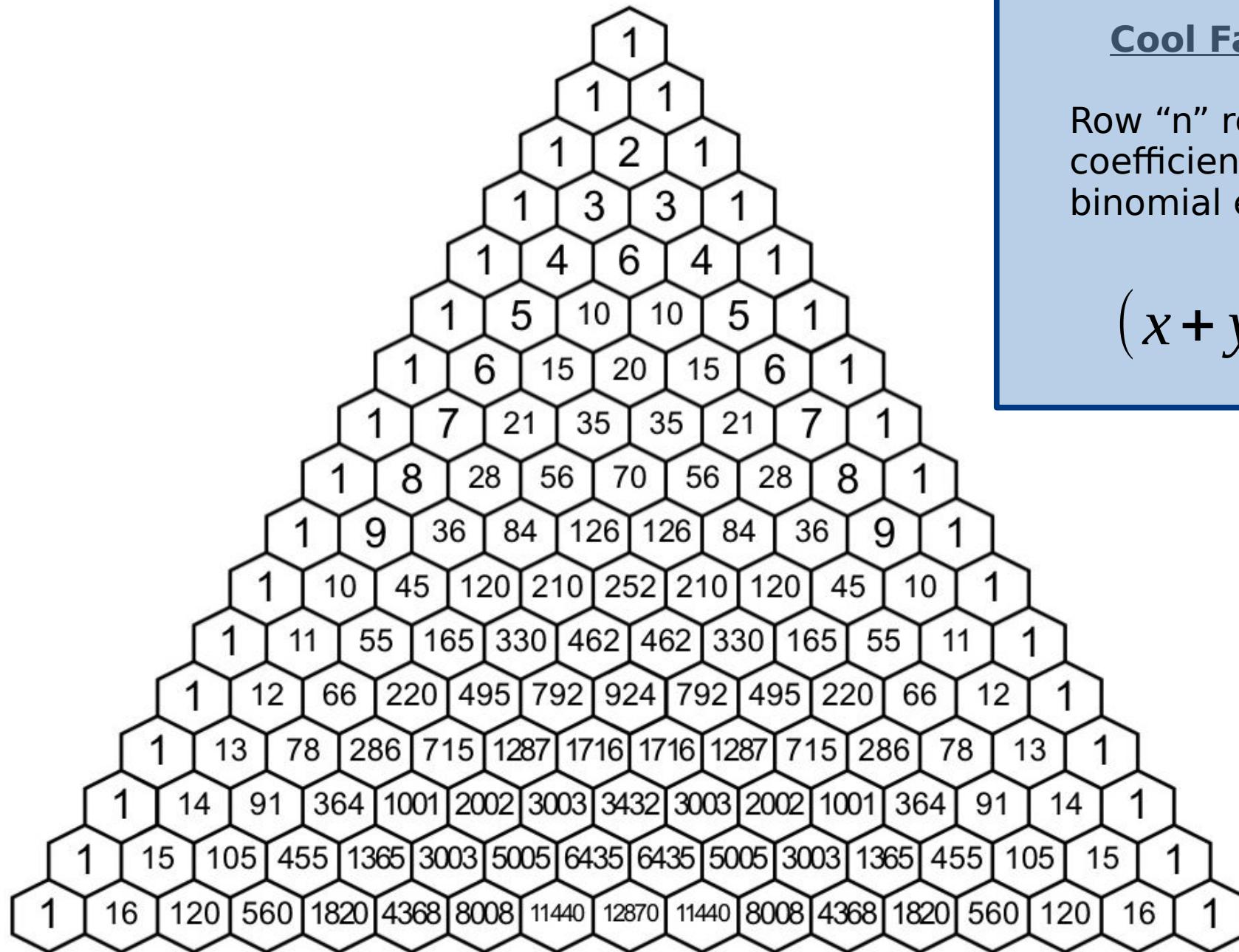
1. Start with a 1
2. Add zero to left and right ends (not part of the triangle)
3. Take the sum of adjacent boxes
4. Using the sums, make a new row below
5. Repeat steps 2 → 4

	0	1	0				
	0	1	1	0			
	0	1	2	1	0		
	0	1	3	3	1	0	
	0	1	4	6	4	1	0

Cool Fact #1

Row “n” represents coefficients to the binomial expansion:

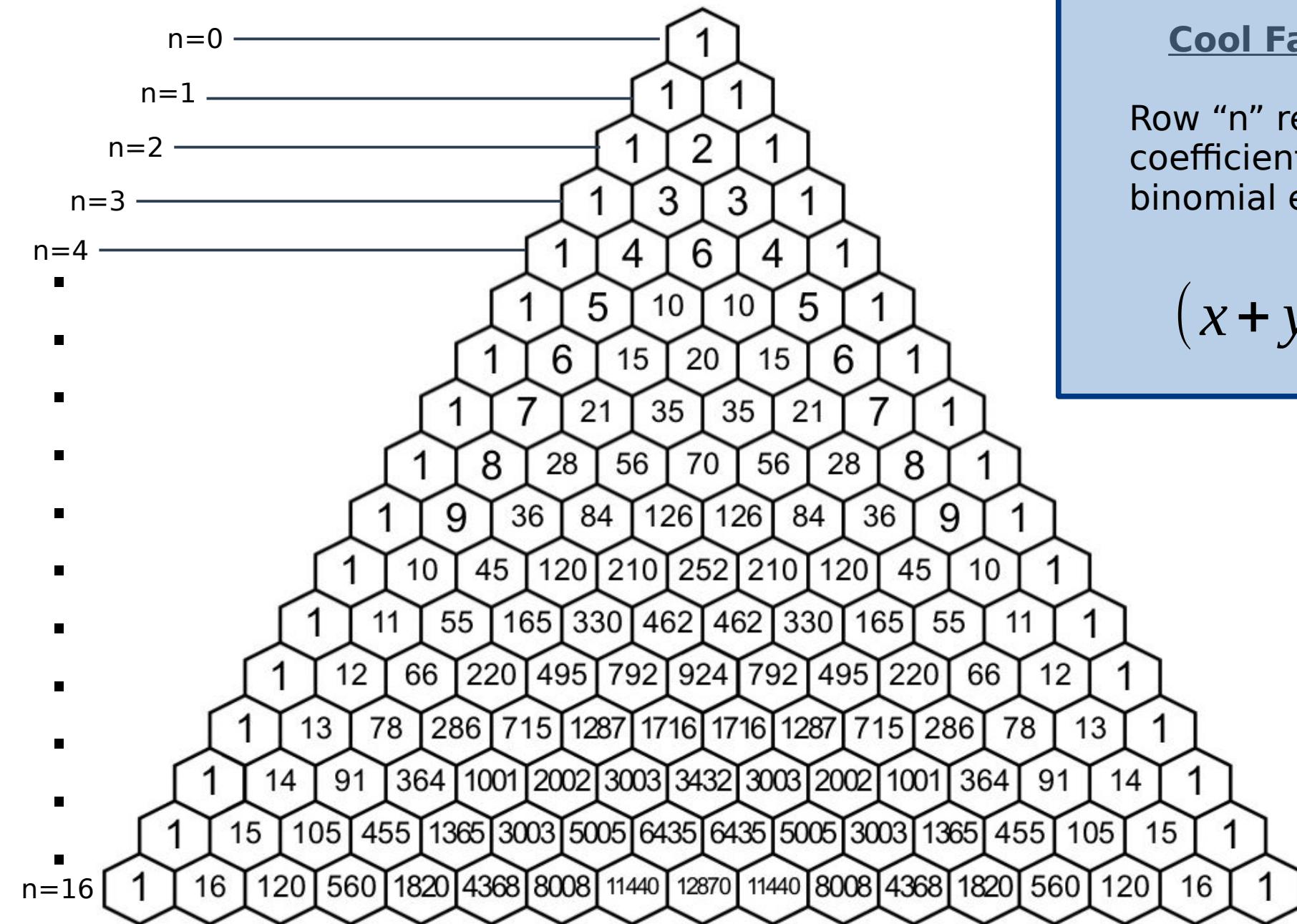
$$(x + y)^n$$



Cool Fact #1

Row “n” represents coefficients to the binomial expansion:

$$(x + y)^n$$



$$n = 0 \quad (x+y)^0 \quad 1$$

$$n = 1 \quad (x+y)^1 \quad 1x + 1y$$

$$n = 2 \quad (x+y)^2 \quad 1x^2 + 2xy + 1y^2$$

$$n = 3 \quad (x+y)^3 \quad 1x^3 + 3x^2y + 3xy^2 + 1y^3$$

$$n = 4 \quad (x+y)^4 \quad 1x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + 1y^4$$

Cool Fact #1

Row “n” represents coefficients to the binomial expansion:

$$(x+y)^n$$

$$n = 0 \quad (x+y)^0$$

1

$$n = 1 \quad (x+y)^1$$

1 x + 1 y

$$n = 2 \quad (x+y)^2$$

1 x² + 2 x y + 1 y²

$$n = 3 \quad (x+y)^3$$

1 x³ + 3 x² y + 3 x y² + 1 y³

$$n = 4 \quad (x+y)^4$$

1 x⁴ + 4 x³ y + 6 x² y² + 4 x y³ + 1 y⁴

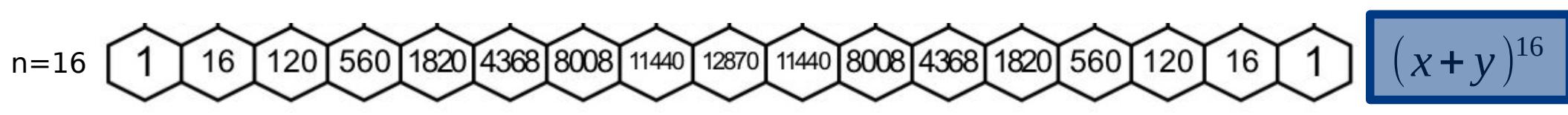
Cool Fact #1

Row “n” represents coefficients to the binomial expansion:

$$(x+y)^n$$

NOTE: Every term $x^a y^b$ satisfies $a+b=n$

0	1	0
0	1	1
0	1	2
0	1	3
0	1	4

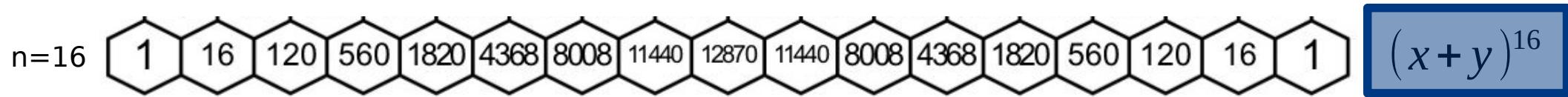


Pascal's Triangle Value	a	b	a+b (n)
1	16	0	16
16	15	1	16
120	14	2	16
560	13	3	16
1,820	12	4	16
4,368	11	5	16
8,008	10	6	16
11,440	9	7	16
12,870	8	8	16
11,440	7	9	16
8,008	6	10	16
4,368	5	11	16
1,820	4	12	16
560	3	13	16
120	2	14	16
16	1	15	16
1	0	16	16

$$\underline{x^a y^b}$$

$$1,820 x^{12} y^4$$

$$11,440 x^7 y^9$$



$$(x+y)^{16} = \dots$$

$$X^{16} + 16X^{15}Y + 120X^{14}Y^2 + 560X^{13}Y^3 + 1820X^{12}Y^4 + 4368X^{11}Y^5 + 8008X^{10}Y^6$$

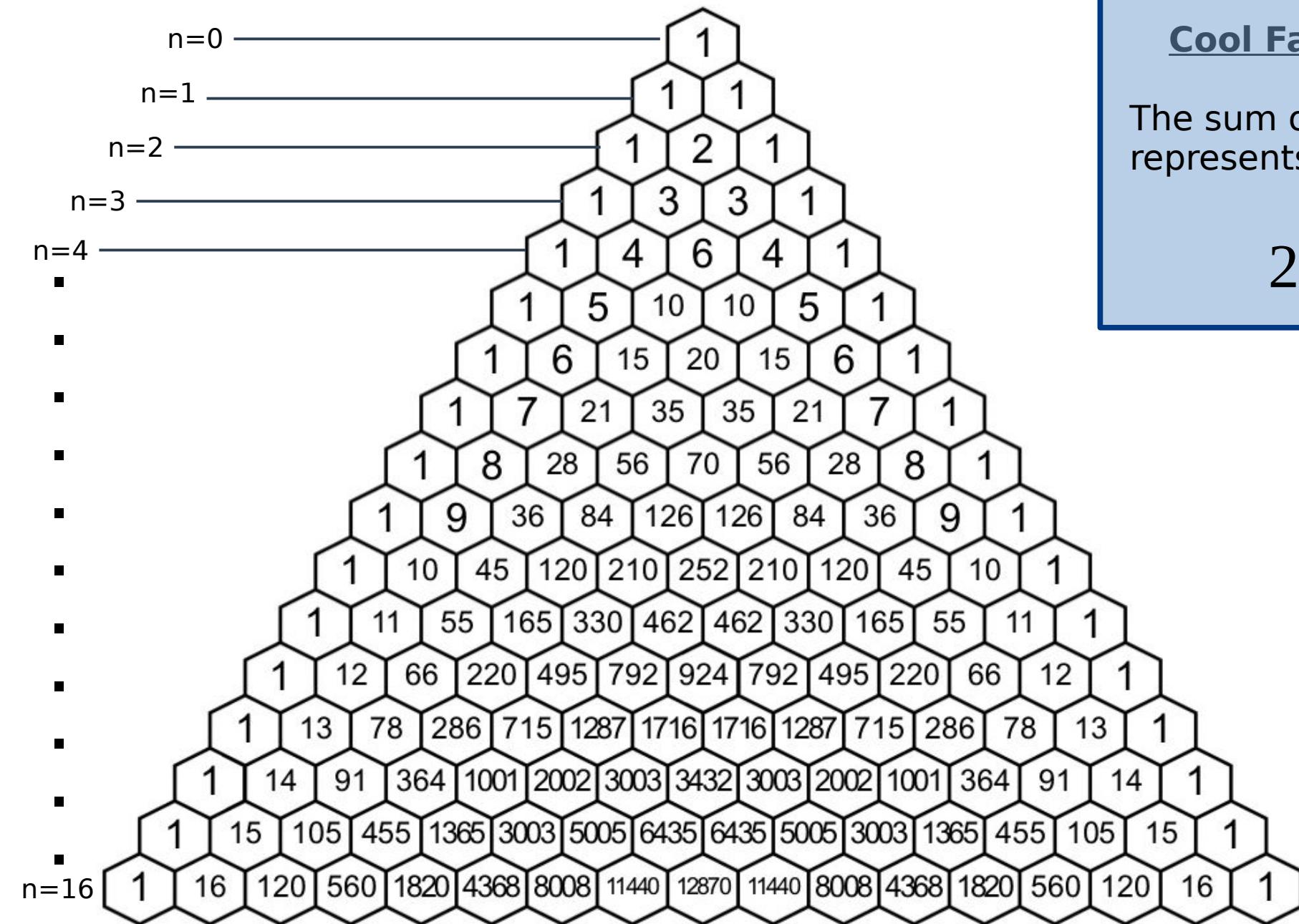
$$+ 11440X^9Y^7 + 12870X^8Y^8 + 11440X^7Y^9 + 8008X^6Y^{10} + 4368X^5Y^{11} + 1820X^4Y^{12}$$

$$+ 560X^3Y^{13} + 120X^2Y^{14} + 16XY^{15} + Y^{16}$$

Cool Fact #2

The sum of row “n” represents:

$$2^n$$



Cool Fact #2

Pascals Triangle

$$n = 0 \quad 2^0 = 1 = 1$$

$$n = 1 \quad 2^1 = 2 = 1+1$$

$$n = 2 \quad 2^2 = 4 = 1+2+1$$

$$n = 3 \quad 2^3 = 8 = 1+3+3+1$$

$$n = 4 \quad 2^4 = 16 = 1+4+6+4+1$$

The sum of row “n” represents:

$$2^n$$



Cool Fact #2

The sum of row “n” represents:

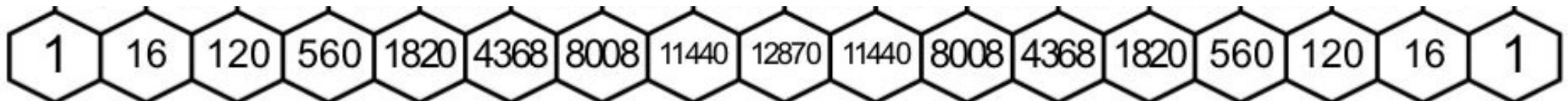
$$2^n$$

$n = 16: \quad 2^{16} = \underline{\hspace{2cm}} \quad 65,536$

$$\begin{aligned} & 1 + 16 + 120 + 560 + 1,820 + 4,368 + 8,008 + 11,440 + 12,870 \\ & + 11,440 + 8,008 + 4,368 + 1,820 + 560 + 120 + 16 + 1 \end{aligned}$$

=

$$\underline{\hspace{2cm}} \quad 65,536$$



Announcements

Computer Programming Club will meet again tomorrow (Wednesday) at 8:00pm in Physics Lab

Topics include:

- SOLVING CHALLENGES
- If statements

Night review session for Elasticity will be next week



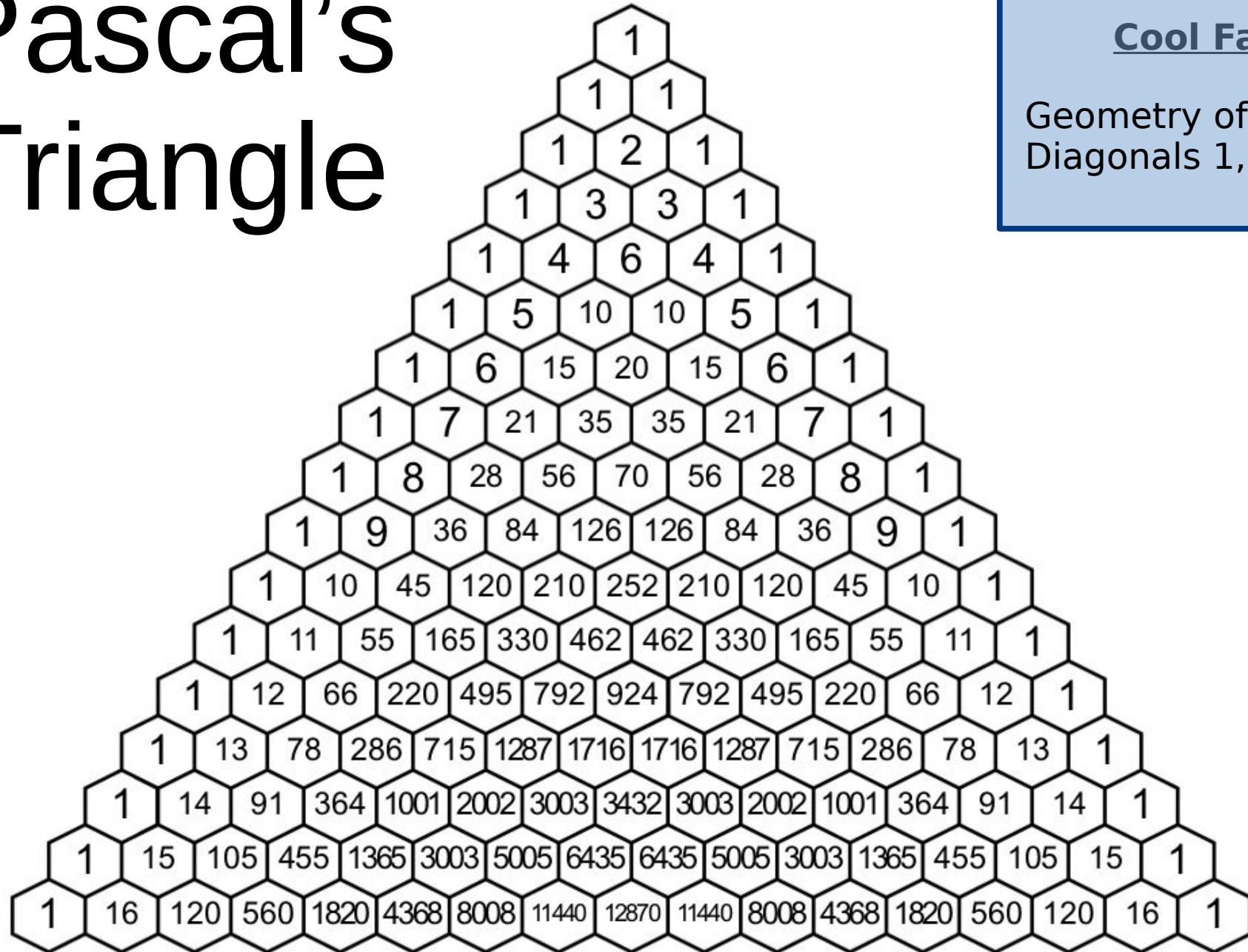
The coolest math thing that you will ever learn

(Part 2/4)

(helpful to physics)

Mwl. Gibson

Pascal's Triangle

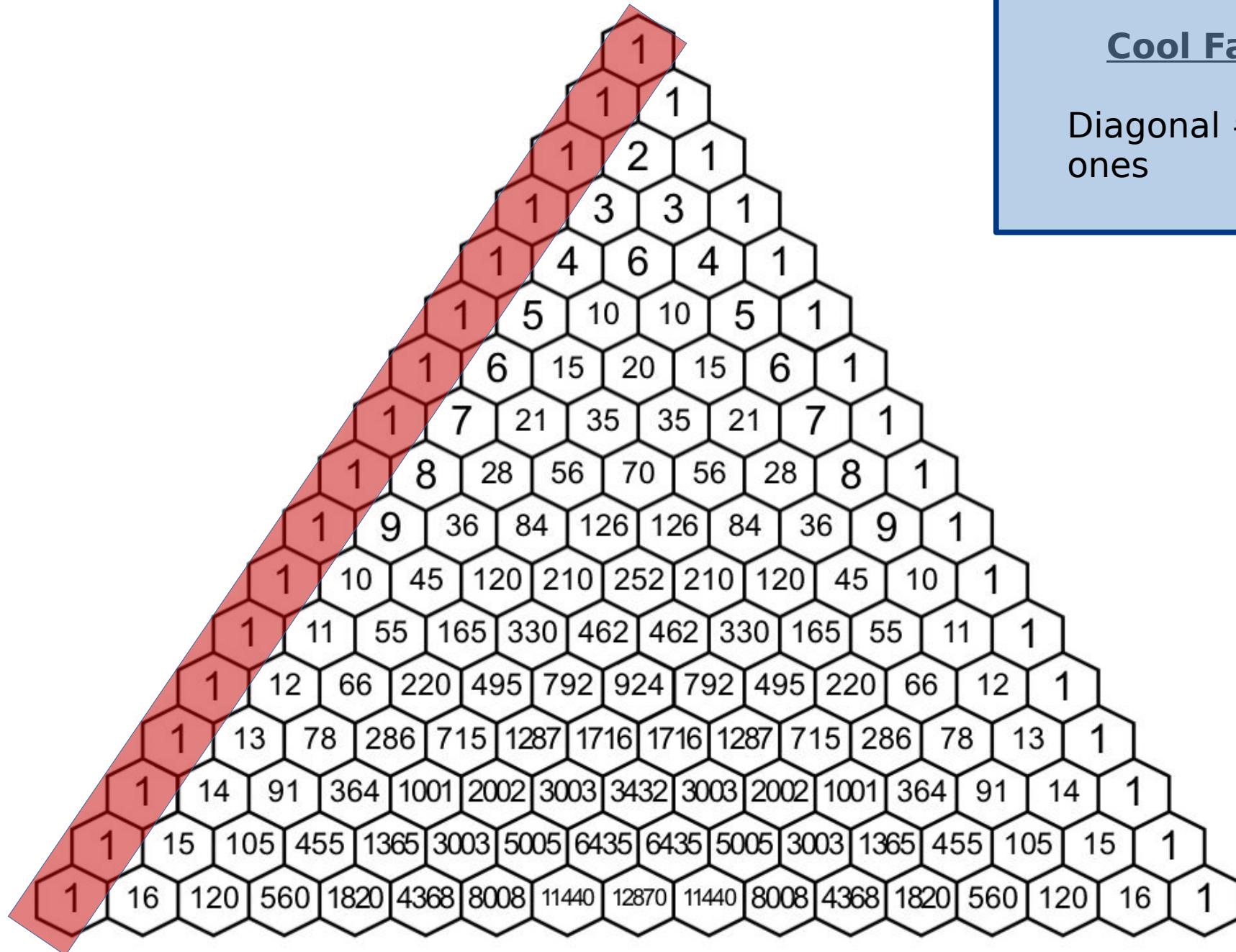


Cool Fact #3

Geometry of
Diagonals 1, 2, 3, & 4

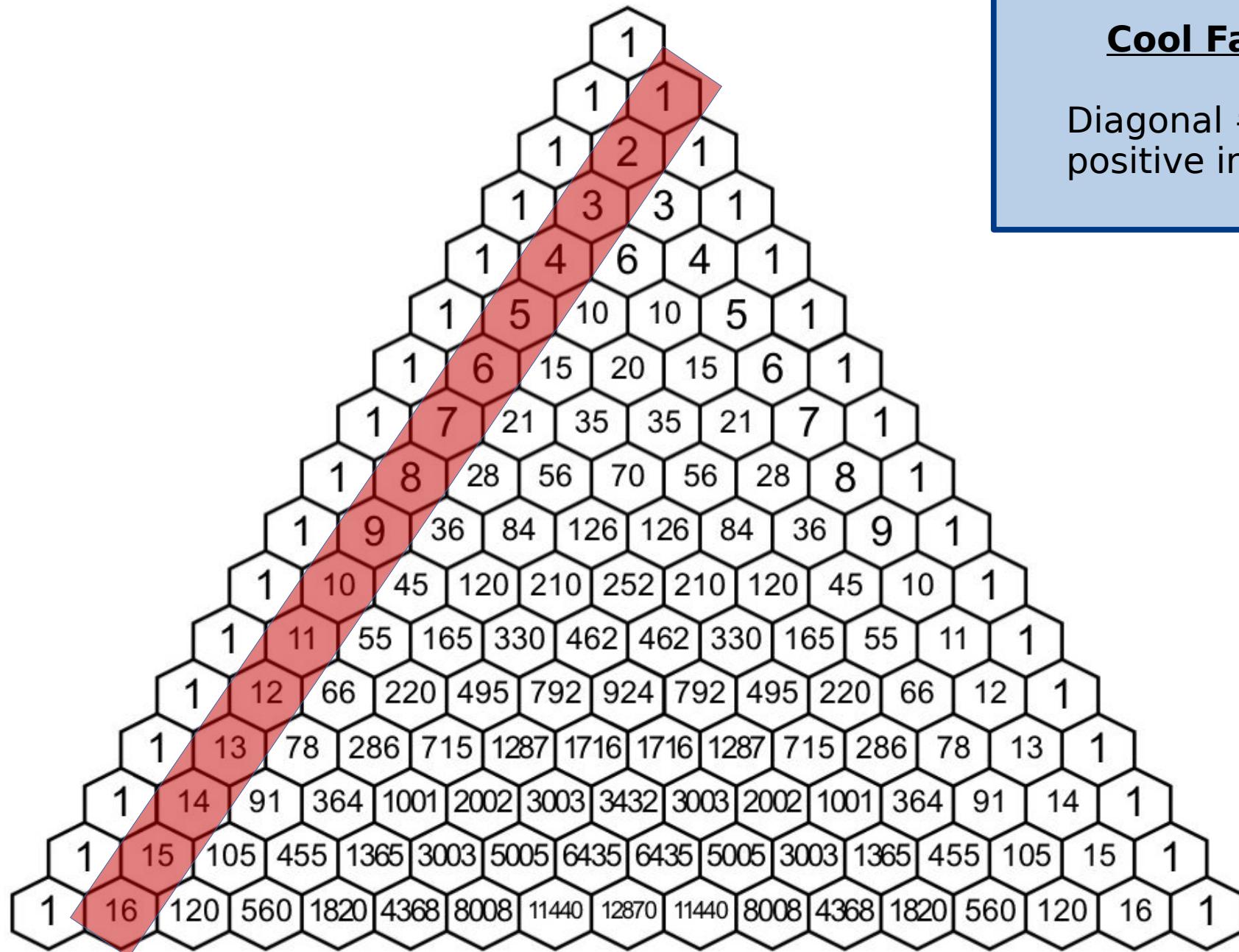
Cool Fact #3a

Diagonal #1 is all ones



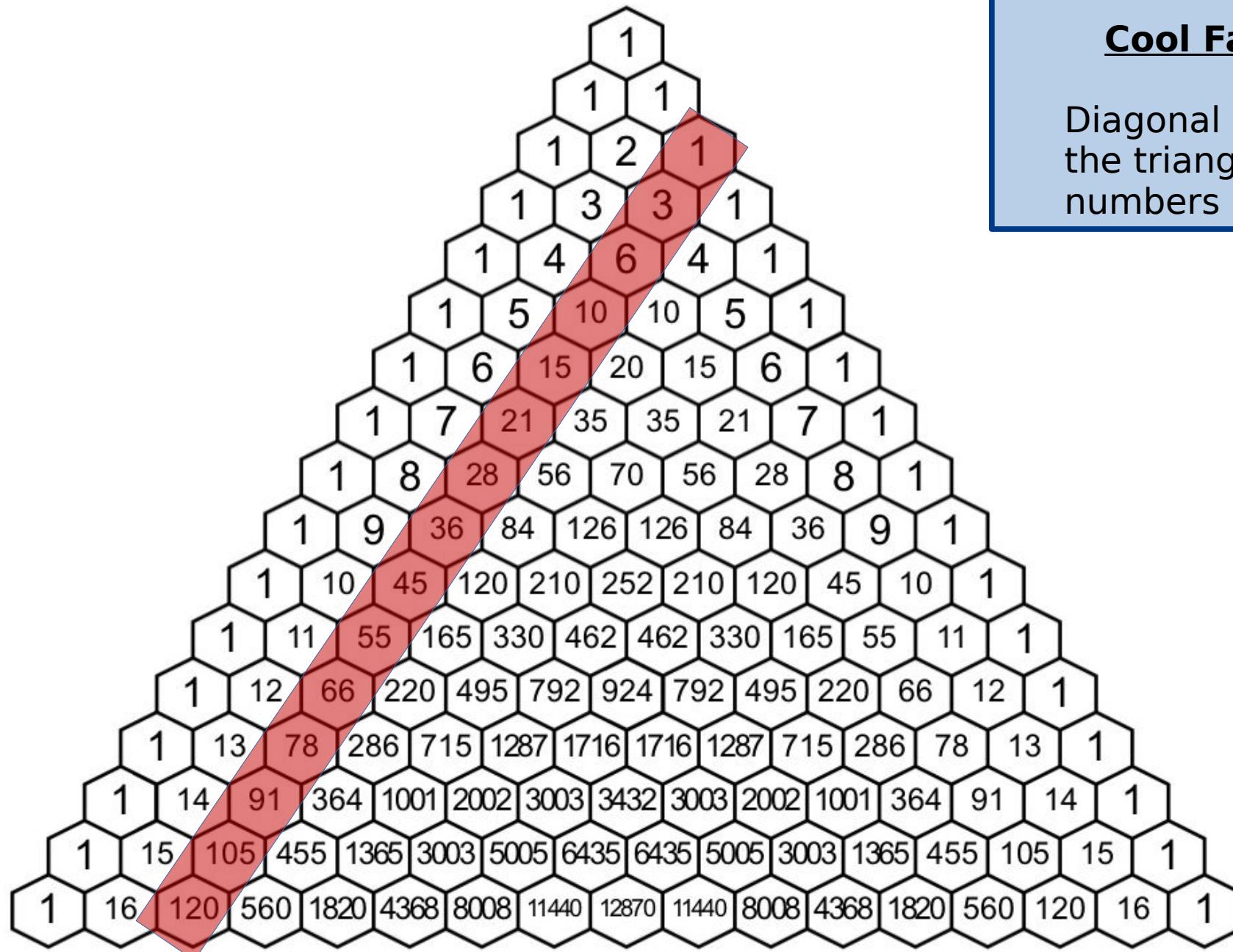
Cool Fact #3b

Diagonal #2 is all positive integers



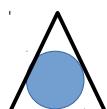
Cool Fact #3c

Diagonal #3 is all the triangular numbers

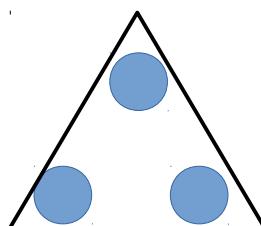


Triangular Numbers

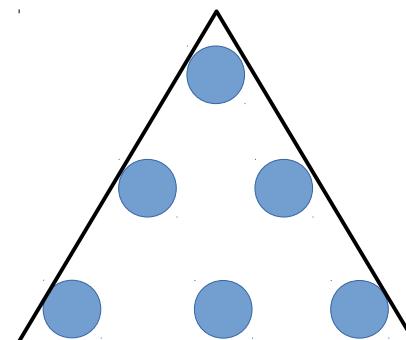
- Number of points to stack into an equilateral triangle.



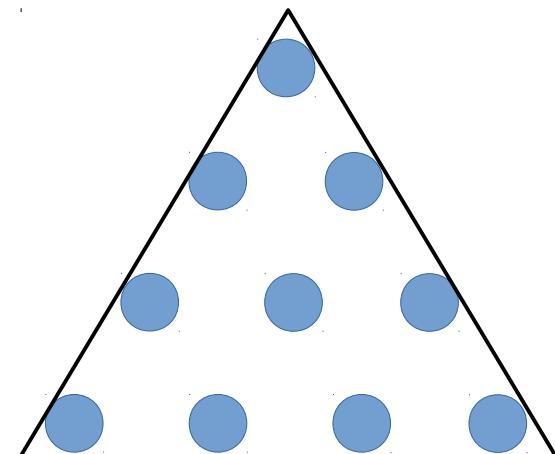
1



3



6

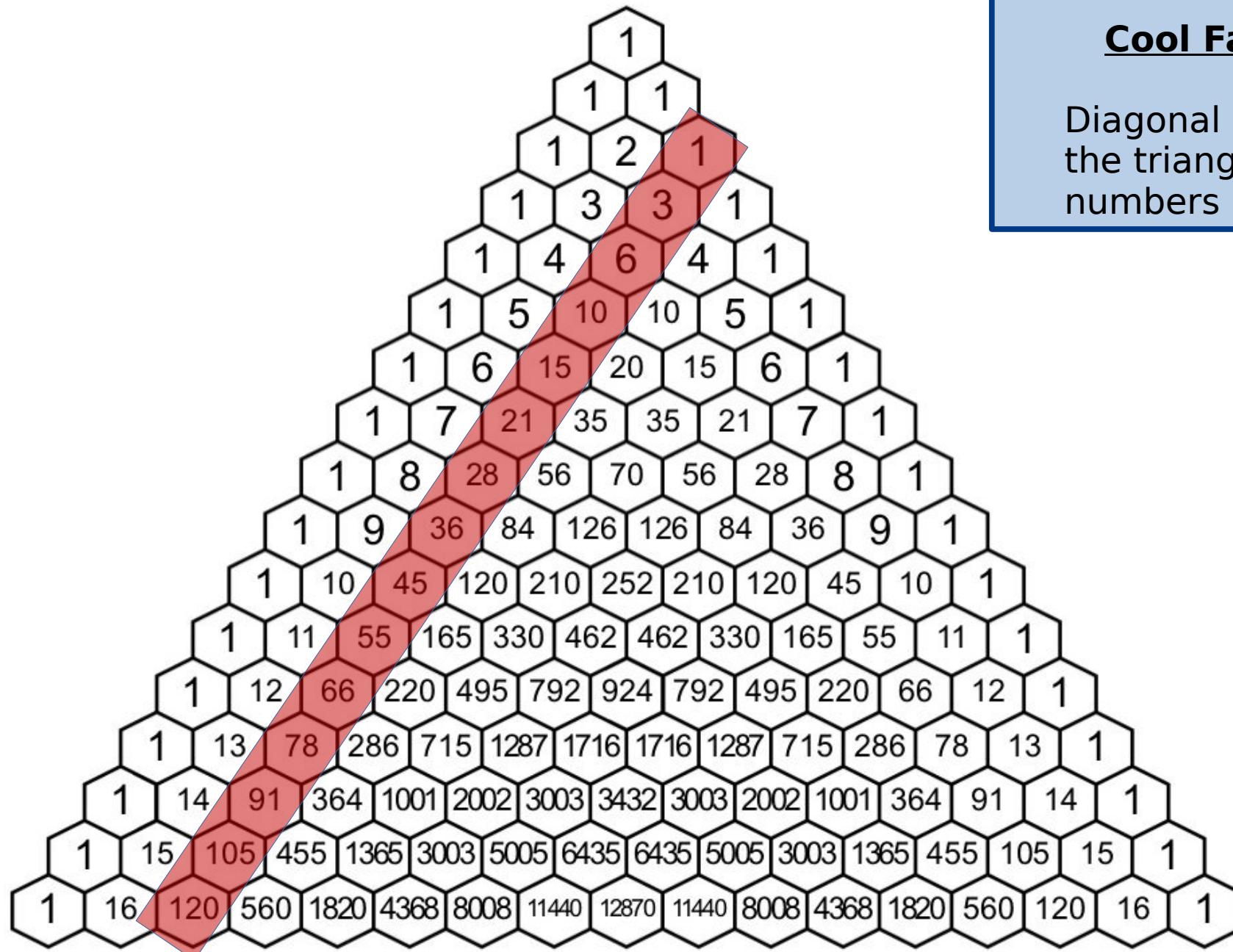


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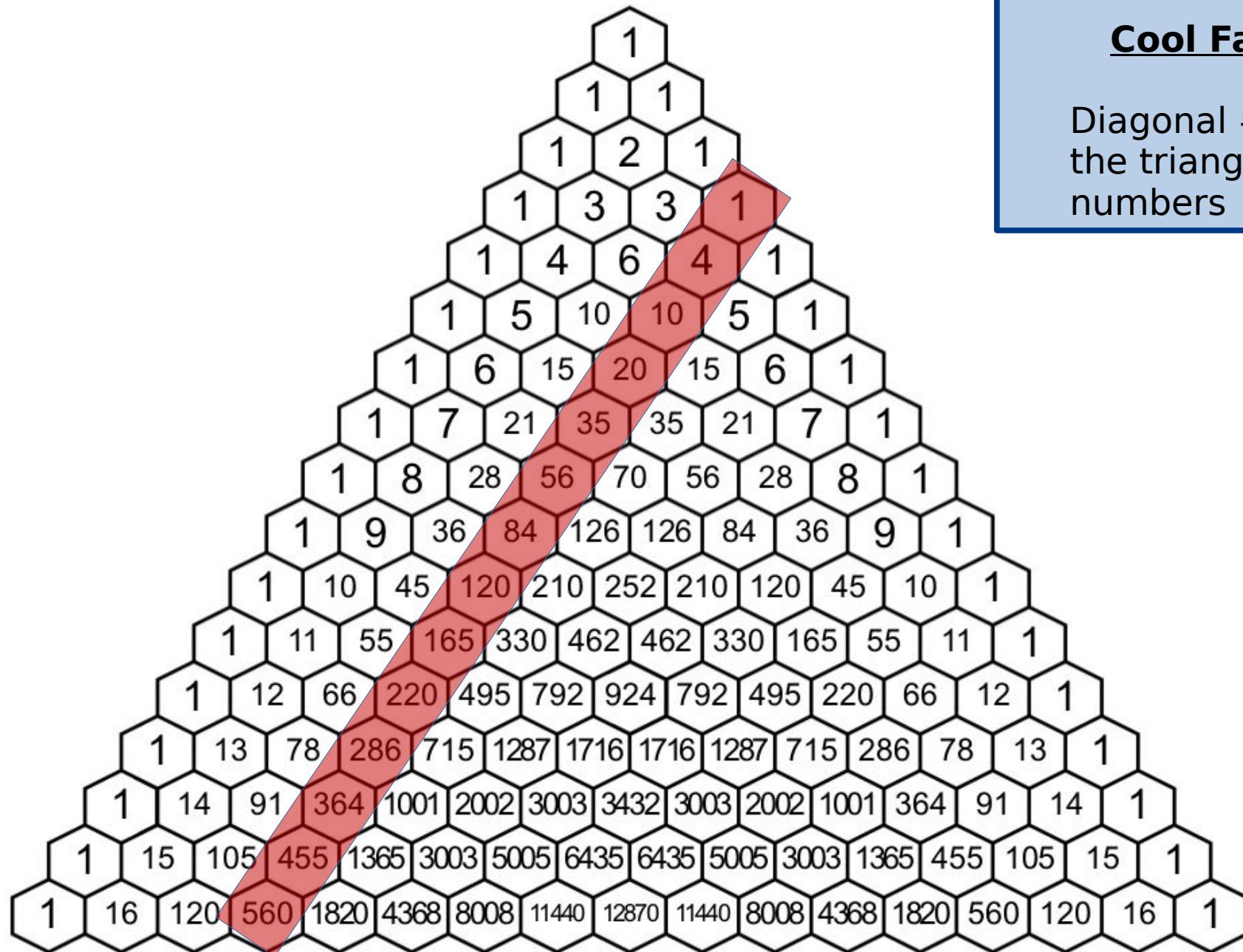
Cool Fact #3c

Diagonal #3 is all the triangular numbers



Cool Fact #3d

Diagonal #4 is all the triangular numbers



Tetrahedral Numbers

- Number of spheres to stack into a equilateral tetrahedron (3D).

