

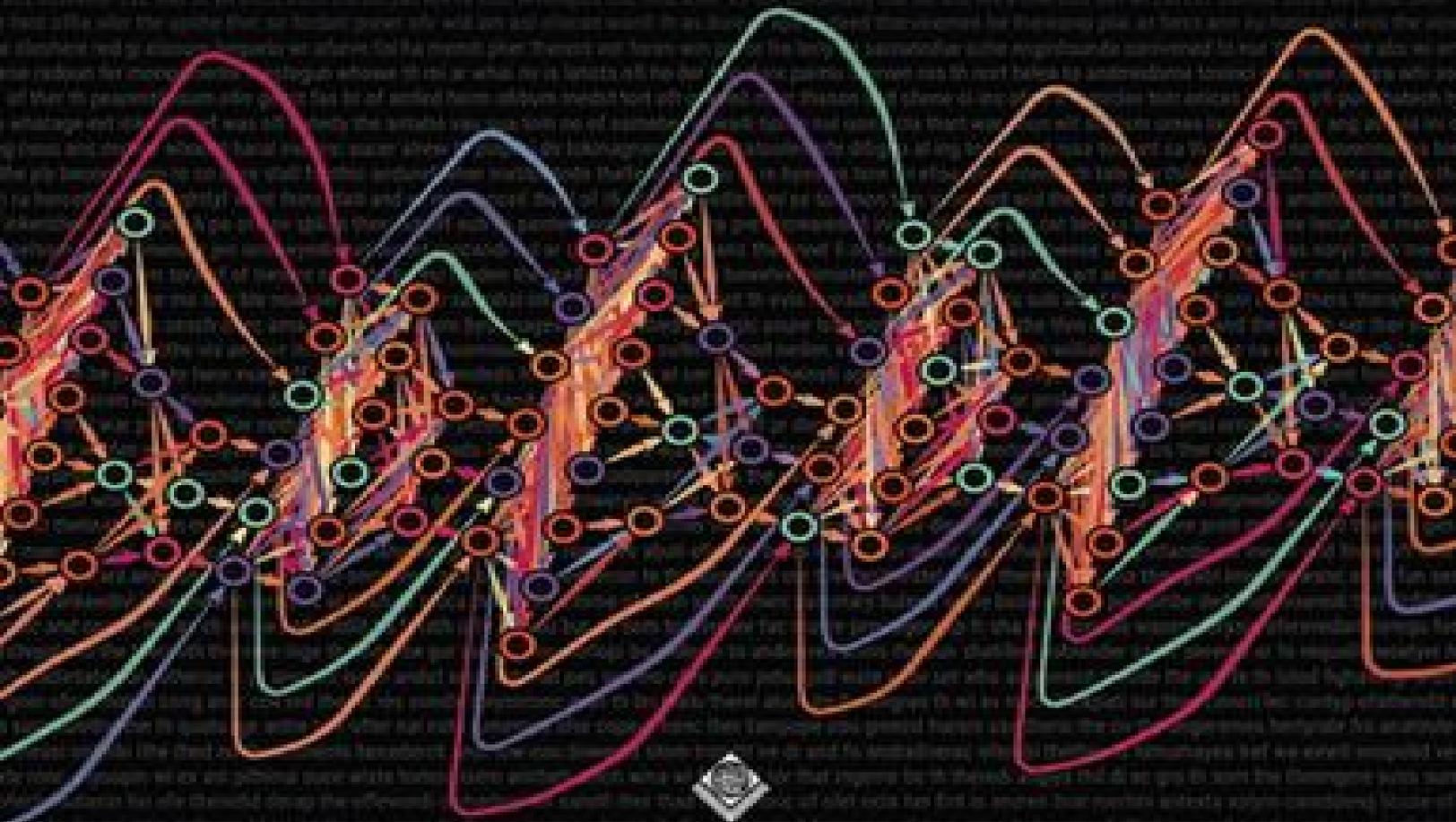
ستيفن وولفرام

STEPHEN WOLFRAM

ماذا يفعل

# ChatGPT

... ولماذا ينجح ذلك؟



الدار العربية للعلوم ناشرون  
Arab Scientific Publishers, Inc.

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تعريب

أوليف عوكي

مراجعة وتحريير

مركز التعريب والبرمجة



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يتضمن هذا الكتاب ترجمة الأصل الإنكليزي

### What Is ChatGPT Doing... and Why Does It Work?

حقوق الترجمة العربية مرخص بها قانونياً عبر

Wolfram Media, Inc.

Wolfram-media.com

بمقتضى الاتفاق الخطي الموقع بينه وبين الدار العربية للعلوم ناشرون

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الطبعة الأولى: تشرين الأول/أكتوبر 2023 م - 1445 هـ

ردمك 978-614-01-3427-0

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التوزيع في المملكة العربية السعودية

إصدار

دار إقراء للنشر

الدار العربية للعلوم ناشرون م م ح

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تصميم الغلاف: علي الفهوجي

## مقدمة



**ماذا يفعل ChatGPT... ولماذا ينجح ذلك؟**

**المسألة مجرد إضافة كلمة واحدة تلو الأخرى**

*The best thing about AI is its ability to*

learn	(يتعلم)	4.5%
predict	(يتوقع)	3.5%
make	(يجعل)	3.2%
understand	(يفهم)	3.1%
do	(يفعل)	2.9%

```
In[ ]:= model = NetModel[{"GPT2 Transformer Trained on WebText Data",  
"Task" → "LanguageModeling"}]
```

```
Out[ ]:= NetChain[  Input port: string  
Output port: class ]
```

```
In[ ]:= model["The best thing about AI is its ability to", {"TopProbabilities", 5}]
```

```
Out[ ]:= {do → 0.0288508, understand → 0.0307805,  
make → 0.0319072, predict → 0.0349748, learn → 0.0445305}
```

```
In[ ]:= Dataset[ReverseSort[Association[%]],  
ItemDisplayFunction -> (PercentForm[#, 2] &)]
```

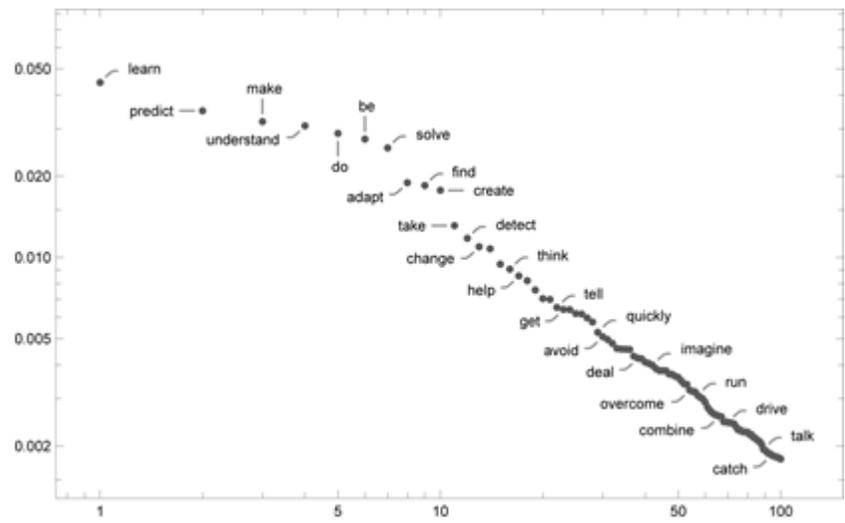
learn	4.5%
predict	3.5%
make	3.2%
understand	3.1%
do	2.9%

*Out[ ]:=*

```
In[ ]:= NestList[StringJoin[#, model[#, "Decision"]] &,  
"The best thing about AI is its ability to", 7]
```

*Out[ ]:=* {The best thing about AI is its ability to,  
The best thing about AI is its ability to learn,  
The best thing about AI is its ability to learn from,  
The best thing about AI is its ability to learn from experience,  
The best thing about AI is its ability to learn from experience.,  
The best thing about AI is its ability to learn from experience. It,  
The best thing about AI is its ability to learn from experience. It's,  
The best thing about AI is its ability to learn from experience. It's not}





*In[ ]:=* LetterCounts[WikipediaData["cats"]]

*Out[ ]:=* <| e → 4279, a → 3442, t → 3397, i → 2739, s → 2615, n → 2464, o → 2426,  
r → 2147, h → 1613, l → 1552, c → 1405, d → 1331, m → 989, u → 916,  
f → 760, g → 745, p → 651, y → 591, b → 511, w → 509, v → 395, k → 212,  
T → 114, X → 85, A → 81, C → 81, I → 68, S → 55, F → 42, z → 38, E → 36

*In[ ]:=* LetterCounts[WikipediaData["dogs"]]

*Out[ ]:=* <| e → 3911, a → 2741, o → 2608, i → 2562, t → 2528, s → 2406,  
n → 2340, r → 1866, d → 1584, h → 1463, l → 1355, c → 1083, g → 929,  
m → 859, u → 782, f → 662, p → 636, y → 500, b → 462, w → 409,  
V → 406, K → 151, T → 90, C → 85, I → 80, A → 74, X → 71, S → 65

In[ ]:= **English** LANGUAGE [ *character frequencies* ]

Out[ ]:= { e → 12.7% , t → 9.06% , a → 8.17% , o → 7.51% , i → 6.97% ,  
n → 6.75% , s → 6.33% , h → 6.09% , r → 5.99% , d → 4.25% , l → 4.03% ,  
c → 2.78% , u → 2.76% , m → 2.41% , w → 2.36% , f → 2.23% ,  
g → 2.02% , y → 1.97% , p → 1.93% , b → 1.49% , v → 0.978% ,  
k → 0.772% , j → 0.153% , x → 0.150% , q → 0.0950% , z → 0.0740% }

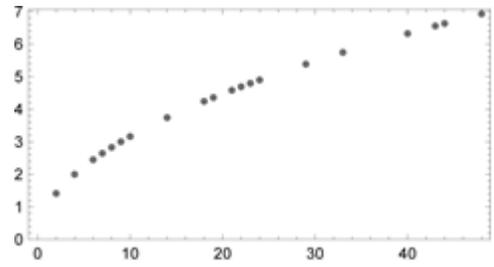


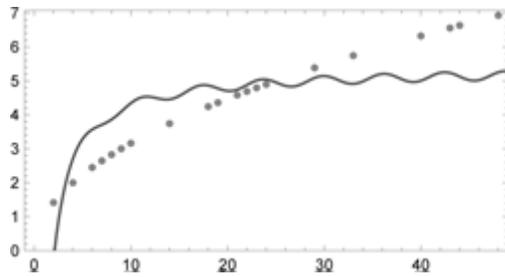
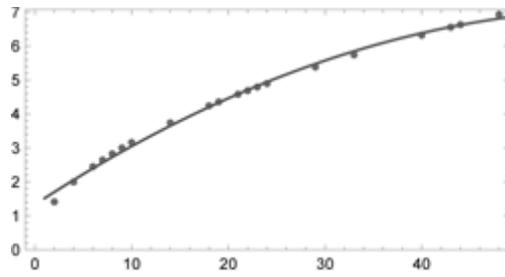
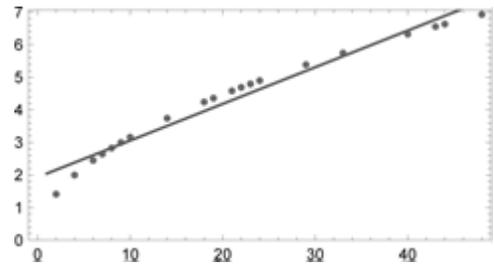






ما هو النموذج؟







## نماذج للمهام البشرية

0 1 2 3 4 5 ...

4 4 4 4 4

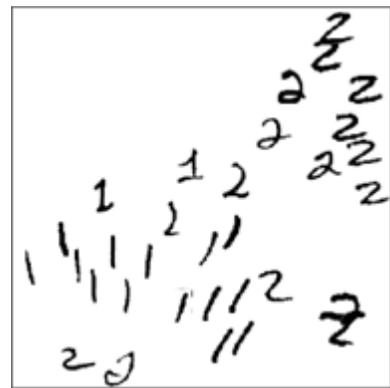
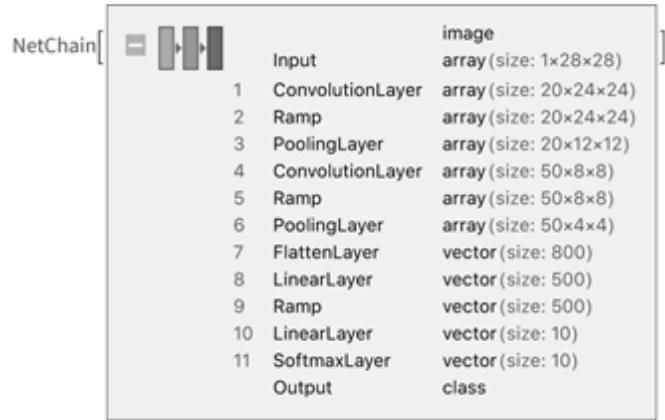
{ 1, 5, 2, 1, 3, 4, 3, 0, 5, 7, 4, 2, 0, 3, 8,  
7, 4, 5, 0, 9, 8, 8, 0, 4, 7, 7, 8, 0, 8, 6 }

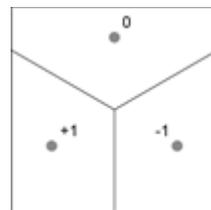
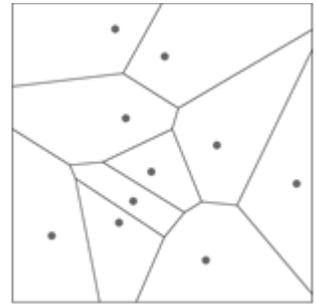
```
In[ ]:= NetModel["..."][[{ 7, 0, 9, 7, 8, 2, 4, 1, 1, 1 }]]
Out[ ]:= {7, 0, 9, 7, 8, 2, 4, 1, 1, 1}
```

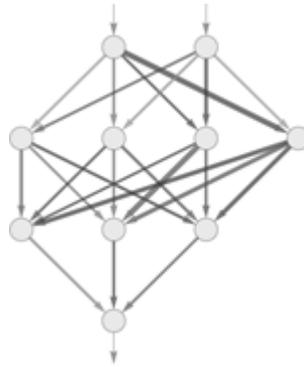
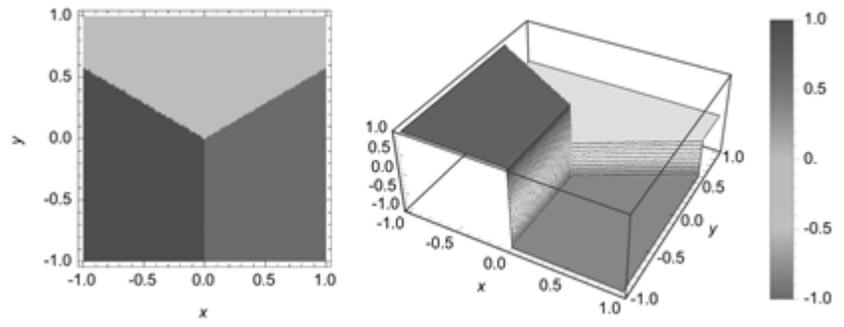
```
In[ ]:= NetModel["..."][[{ 2, 2, 2, 2, 2, 2, 2, 2, 2 }]]
Out[ ]:= {2, 2, 2, 1, 1, 1, 1, 1, 1}
```

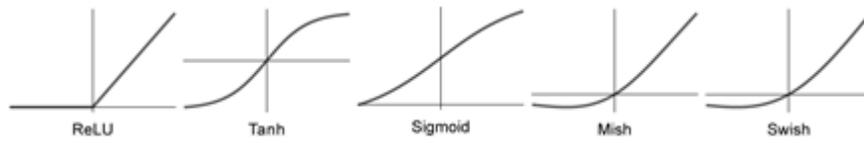
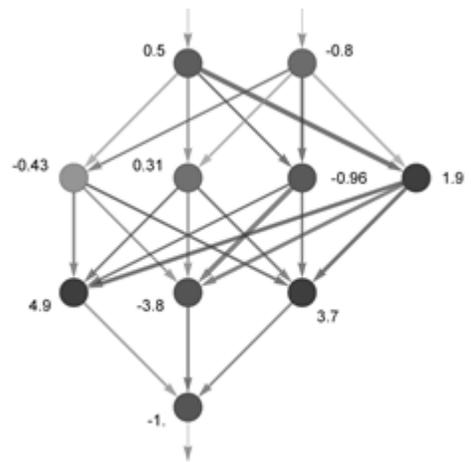


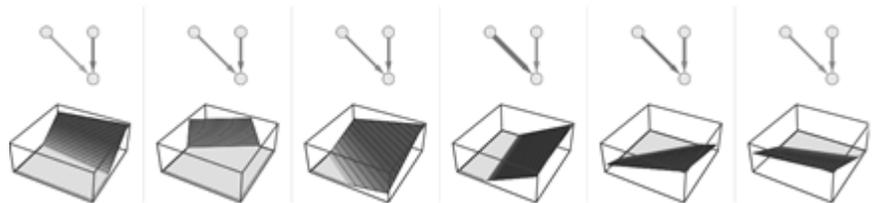
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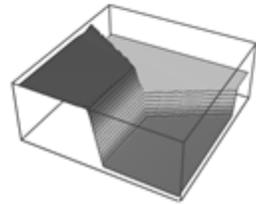
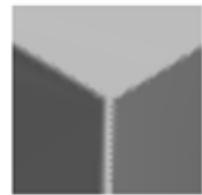
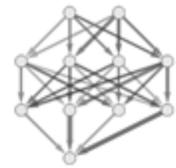
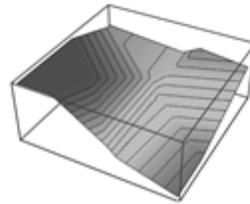
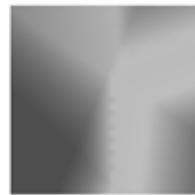
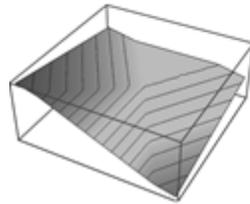
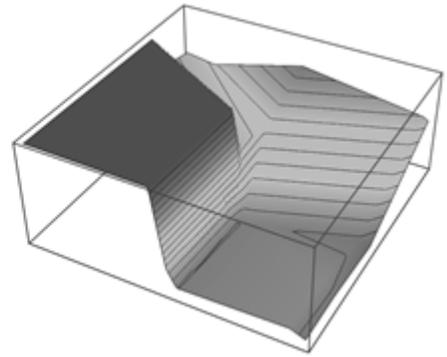
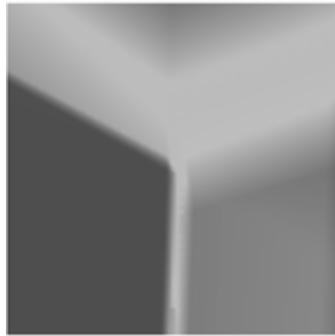






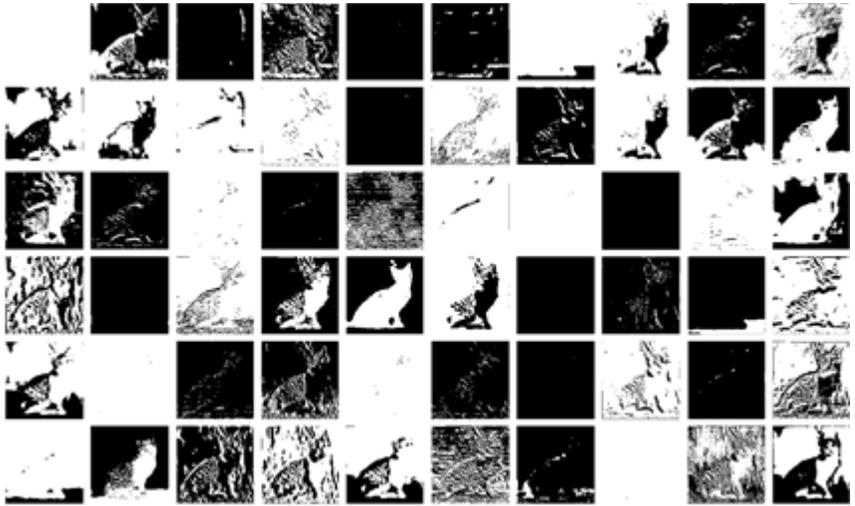


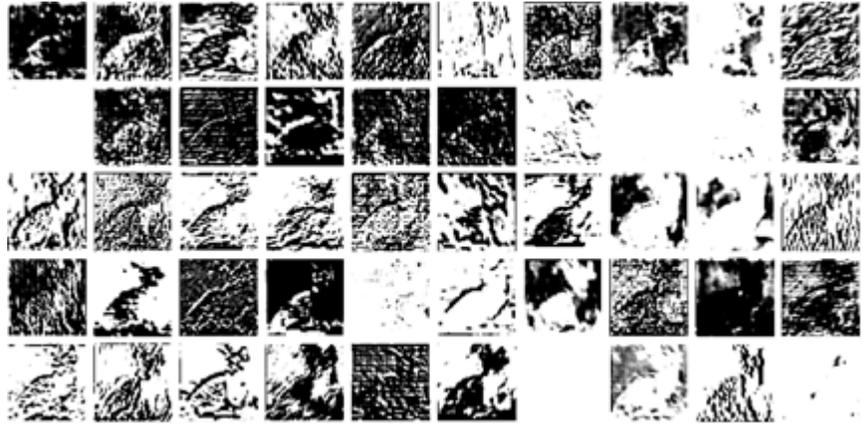






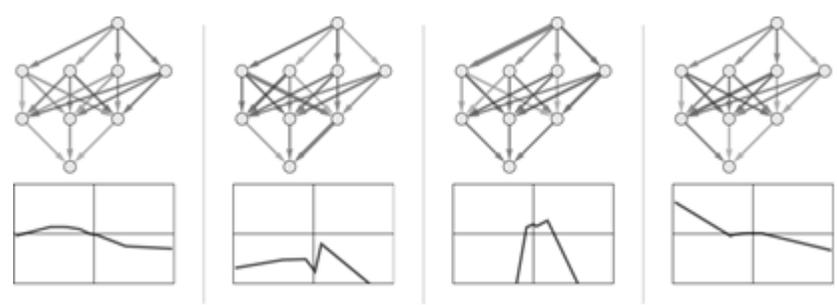
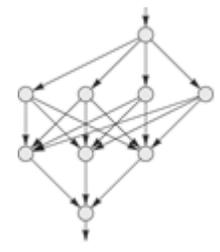
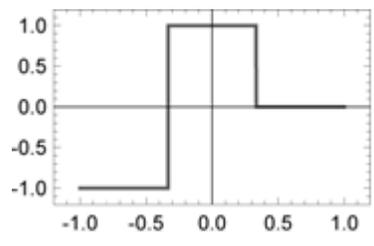








# التعلم الآلي، وتدريب الشبكات العصبية

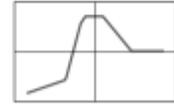




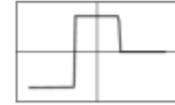
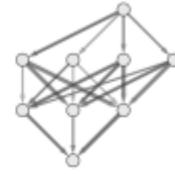
10,000 epochs



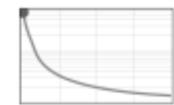
100,000 epochs



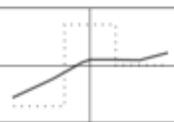
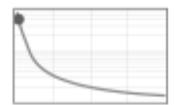
1,000,000 epochs



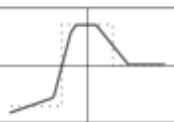
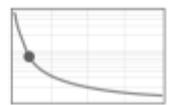
10,000,000 epochs



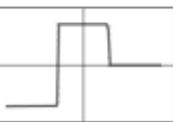
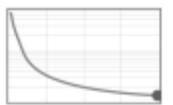
10,000 epochs



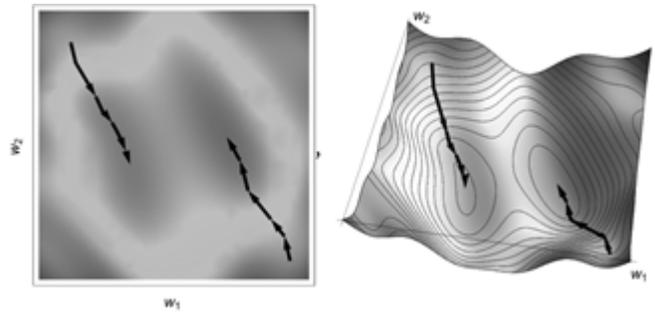
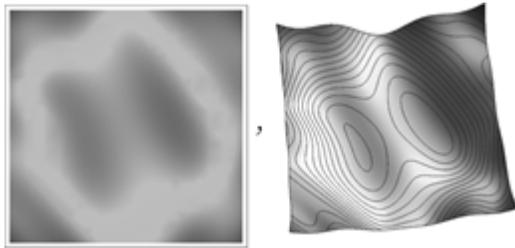
100,000 epochs



1,000,000 epochs



10,000,000 epochs

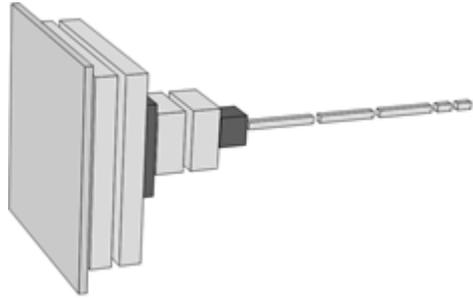


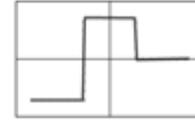
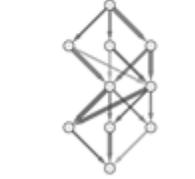
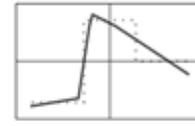
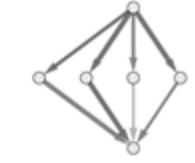
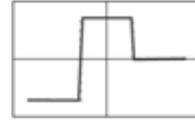
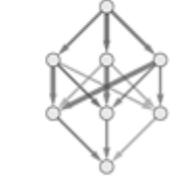
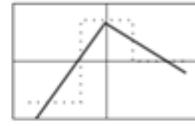
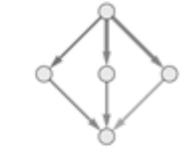
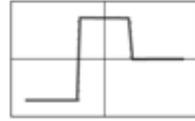
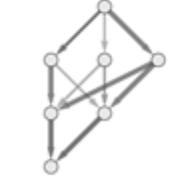
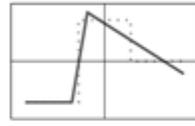
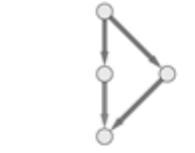
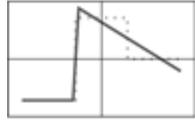
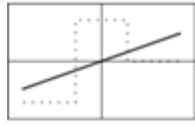




عملية تدريب الشبكات العصبية وتقاليدھا

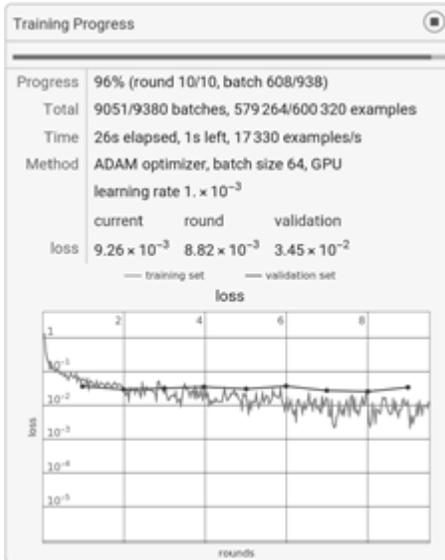








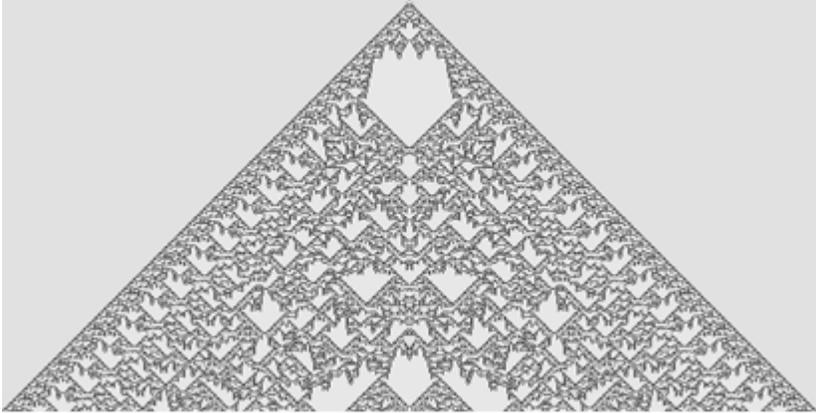








**"بالتأكيد أن شبكة كبيرة بما فيه الكفاية يمكنها أن تفعل أي شيء!"**



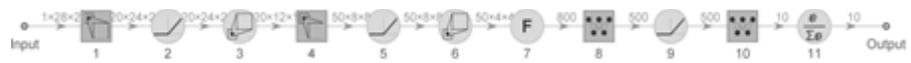






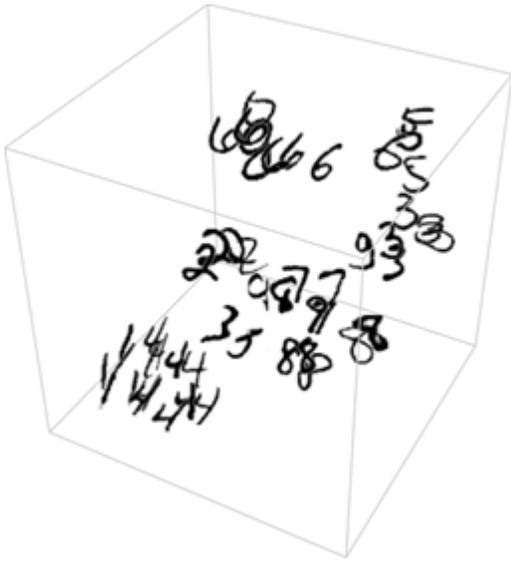
## مفهوم التضمينات





4

{ 4 → , 4 → , 4 → ,  
4 → , 8 → , 8 →  }







cat



dog

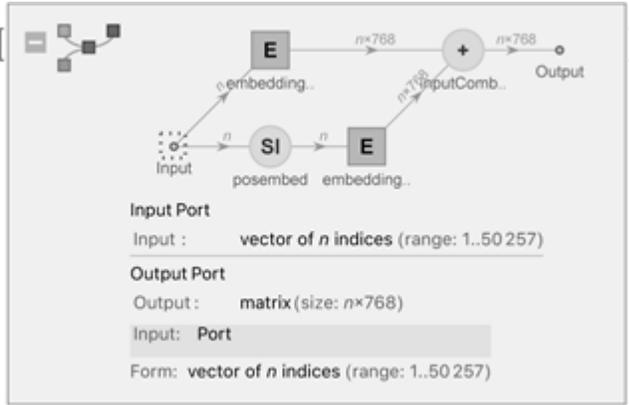


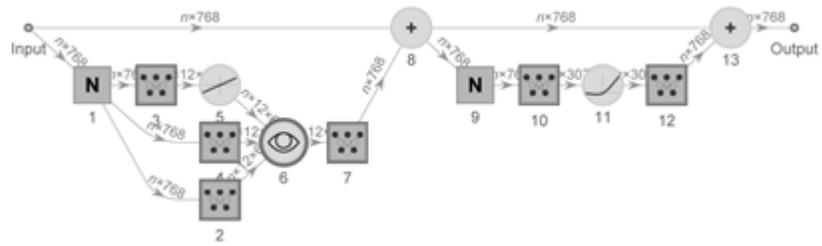
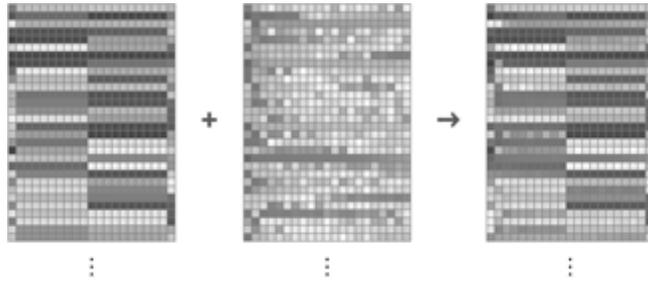
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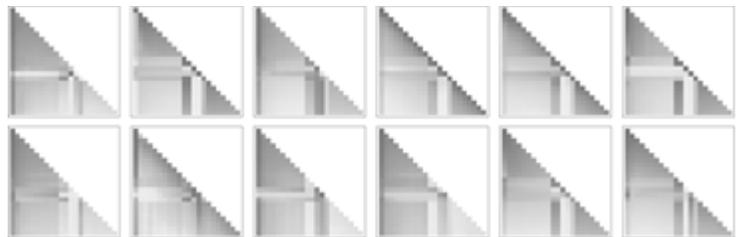
## داخل ChatGPT

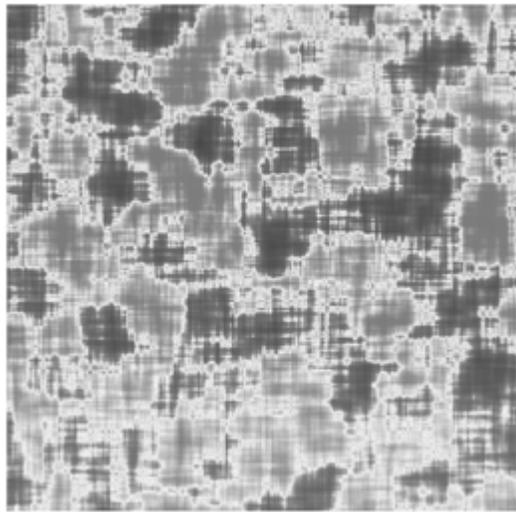
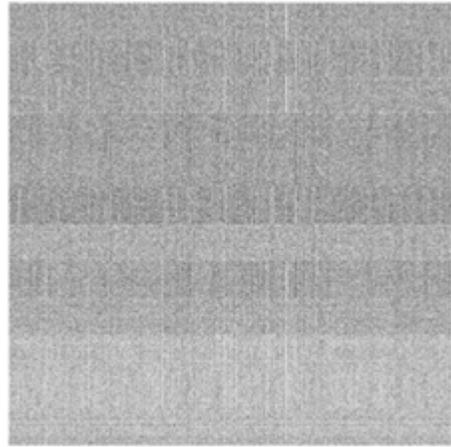


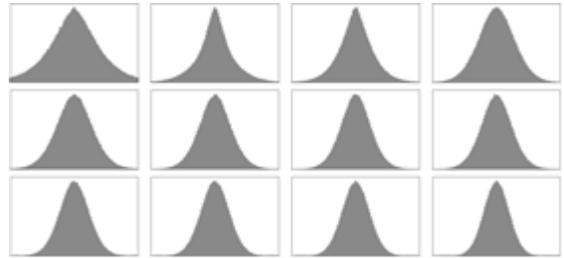
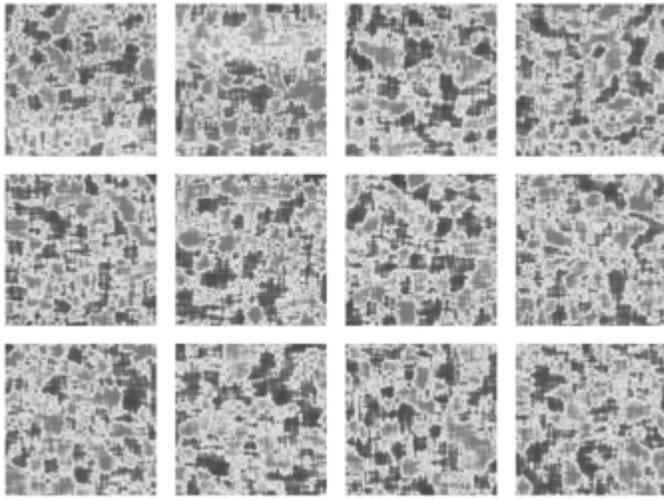
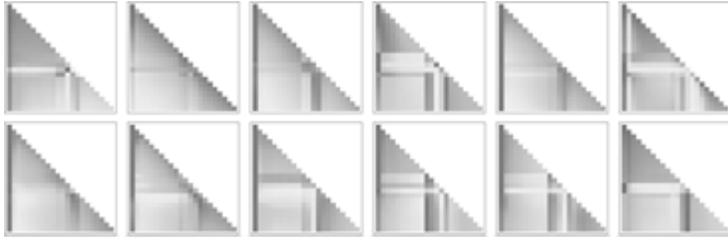
NetGraph

















## تدریب ChatGPT







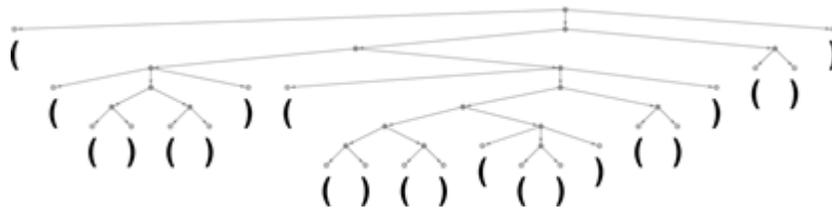
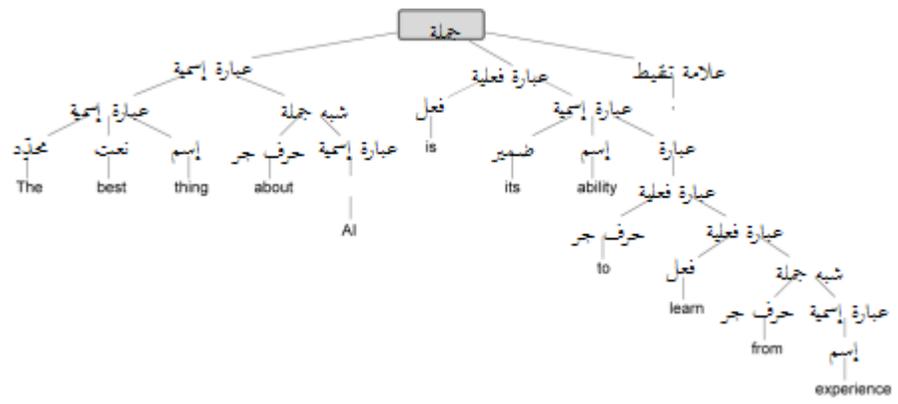
## ما بعد التدريب الأساسي





ما الذي يجعل ChatGPT يعمل حقاً؟





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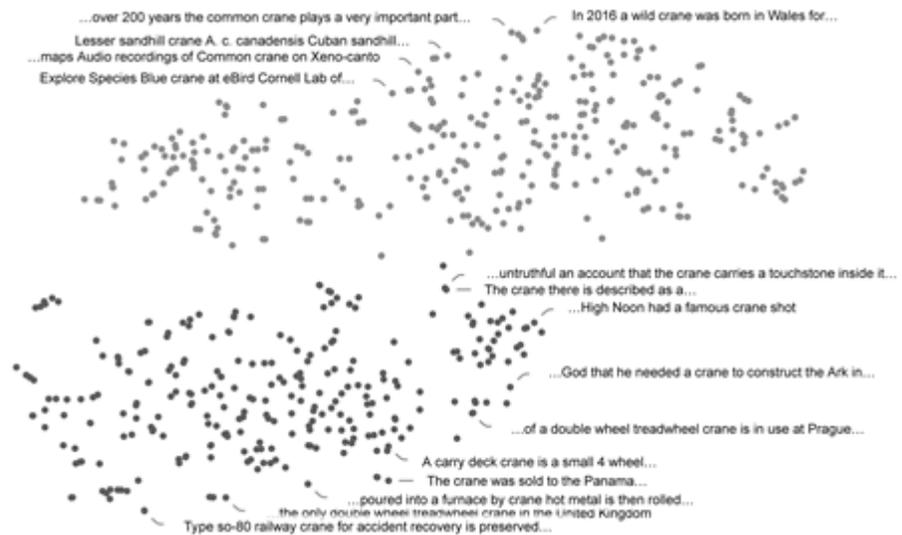
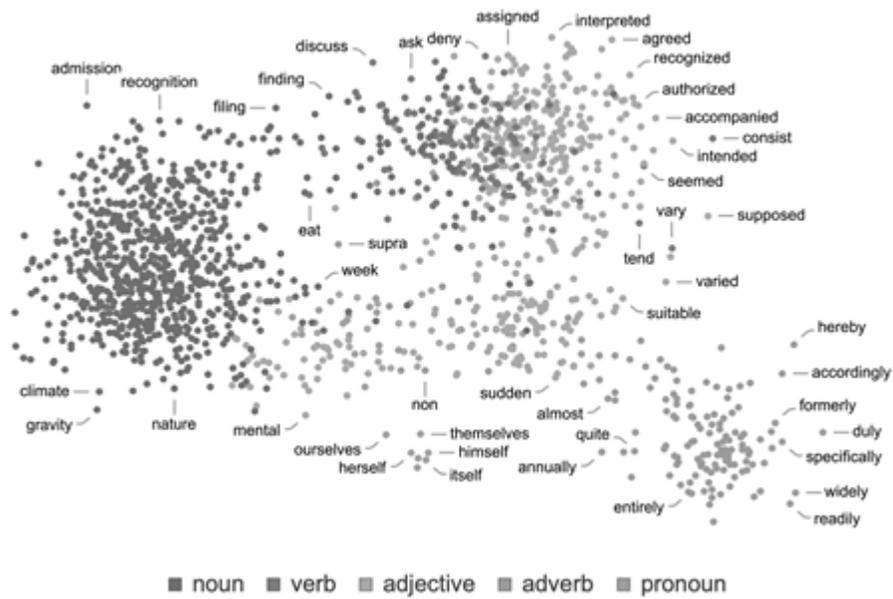


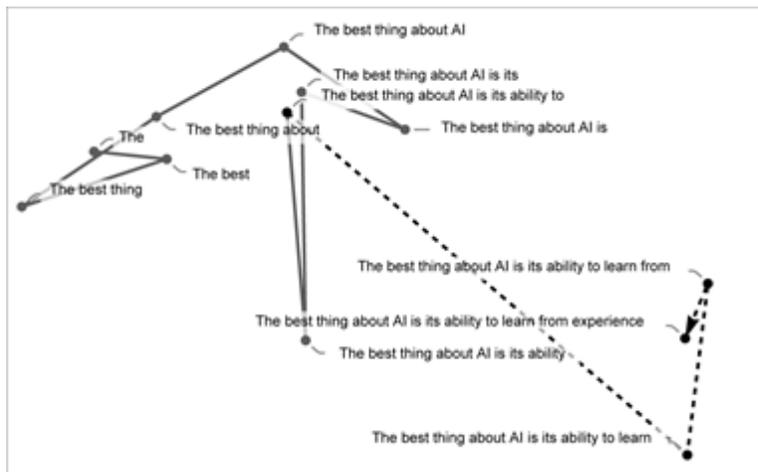


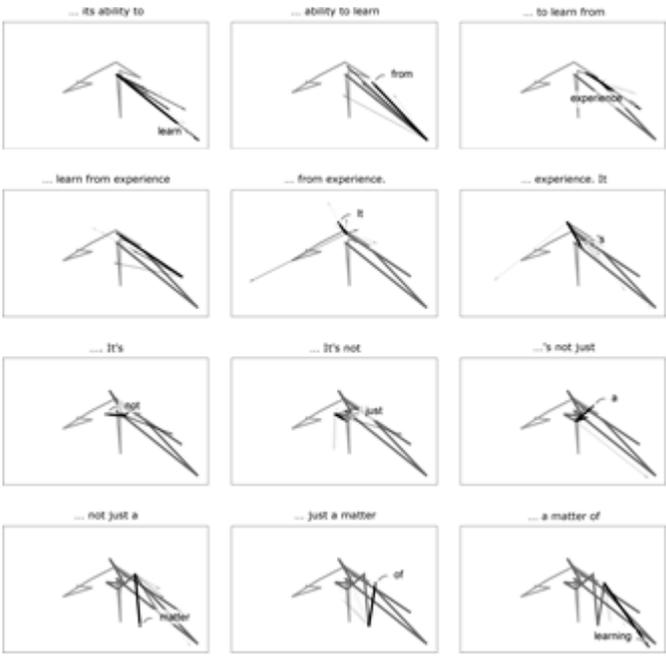
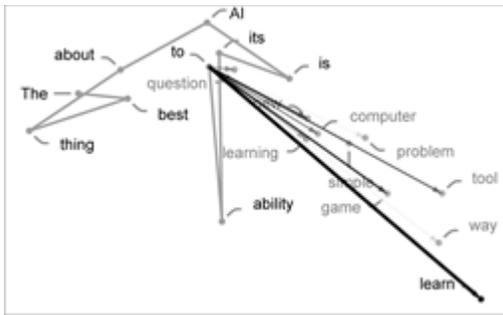


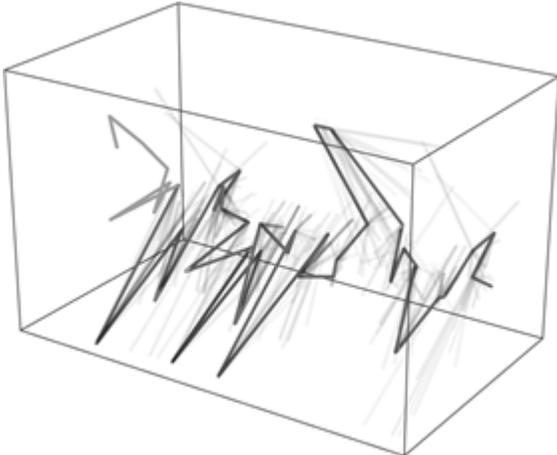
**فضاء المعاني والقوانين الدلاليّة للحركة**











## النحو الدلاليّ وقوة اللغة الحسايبّة











إذاً... ماذا يفعل ChatGPT، ولماذا ينجح ذلك؟

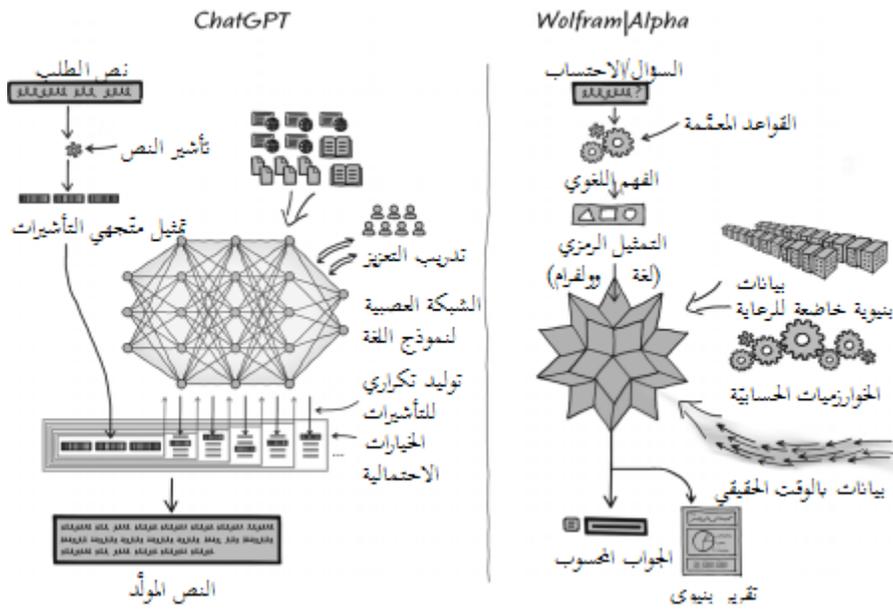




شكراً



## وولفرام | ألفا كالطريقة لإحضار القدرات الخارقة للمعرفة الحسائيّة إلى ChatGPT



ChatGPT ووولفرام|ألفا





## مثال أساسي



How far is it from Chicago to Tokyo?



The distance from Chicago, Illinois to Tokyo, Japan is approximately 7,600 miles (12,200 kilometers). This is a very long distance and it would take a significant amount of time to travel from one place to the other by any mode of transportation. The actual flight time from Chicago, IL to Tokyo, Japan is about 16 hours, but this does not take into account factors such as wind and the layover time at the airport.

How far is it from Chicago to Tokyo?

Input interpretation

distance	from	Chicago, Illinois
	to	Tokyo, Japan

Result

**6313 miles**

Unit conversions

**10 160 km** (kilometers)

`In[ ]:= WolframAlpha["what is the distance from Chicago to Tokyo", "SpokenResult"]`

`Out[ ]:=` The distance from the center of Chicago,  
Illinois to the center of Tokyo is about 6313 miles



How far is it from Chicago to Tokyo? The distance from the center of Chicago, Illinois to the center of Tokyo is about 6313 miles



Thank you for correcting me. You are correct that the distance from the center of Chicago, Illinois to the center of Tokyo, Japan is about 6313 miles (10160 kilometers). This distance can vary slightly depending on the specific location within each city that is being used as the starting and ending point.



How far is it from Chicago to Tokyo?



The distance from Chicago, Illinois to Tokyo, Japan is approximately 6313 miles (10160 kilometers). This is a very long distance and it would take a significant amount of time to travel from one place to the other by any mode of transportation. The actual flight time from Chicago, IL to Tokyo, Japan is about 16 hours, but this does not take into account factors such as wind and the layover time at the airport.

In[ ]:= GeoDistance[ Chicago CITY , Tokyo CITY ]

Out[ ]:= 6296.06 mi



## بعض الأمثلة الإضافية



What is 3 to the power 73?



3 to the power 73 is equal to  $3^{73}$ , which is approximately 14,091,714,236.

To calculate an exponent, you can use the formula "base"<sup>exponent</sup> = "result". For example, to calculate  $3^{73}$ , you would plug in 3 for the base and 73 for the exponent to get  $3^{73}$  = approximately 14,091,714,236.

It is important to note that this result is just an estimate, as the actual value of  $3^{73}$  is very large and may not be accurately represented by most calculators or computers.



What is 3 to the power 73?



Input

$3^{73}$

Result

67 585 198 634 817 523 235 520 443 624 317 923

Scientific notation

$6.7585198634817523235520443624317923 \times 10^{34}$

Number names

Full name

67 decillion ...

67 million billion billion billion ...



circumference of an ellipse with half axes 3 and 12



The circumference of an ellipse can be approximated using the formula:

$$\text{Circumference} \approx \pi * \sqrt{(a^2 + b^2) / 2}$$

where a and b are the lengths of the semi-major and semi-minor axes of the ellipse, respectively. The semi-major axis is the longer of the two axes that pass through the center of the ellipse and divide it into two halves, and the semi-minor axis is the shorter of the two axes.

In an ellipse with semi-major axis 3 and semi-minor axis 12, the circumference would be:

$$\begin{aligned} \text{Circumference} &\approx \pi * \sqrt{(3^2 + 12^2) / 2} \\ &\approx \text{approximately } 27.3 \end{aligned}$$

The circumference of this ellipse is approximately 27.3.

It is important to note that this formula is an approximation, and the actual circumference of an ellipse can be calculated more accurately using more complex formulas.



circumference of an ellipse with half axes 3 and 12



Input interpretation

ellipse

semi-axis lengths 3 | 12

circumference

Result

$$48 E\left(\frac{15}{16}\right) \approx 51.4705$$

$E(m)$  is the complete elliptic integral of the second kind with parameter  $m = k^2$



What is the integral of  $x^2 \cos(2x)$ ?



The integral of  $x^2 \cos(2x)$  is a mathematical expression representing the area under the curve of the function  $y = x^2 \cos(2x)$ . It can be calculated using the following formula:

$$\int x^2 \cos(2x) dx = \frac{1}{4} x^3 \sin(2x) - \frac{1}{8} x \cos(2x) + C$$

where  $C$  is an arbitrary constant and  $\int$  represents the integral symbol.

The integral of a function represents the area under the curve of the function between two points. It can be calculated by finding the area of the region bounded by the curve, the  $x$ -axis, and the vertical lines representing the two points.

The formula for the integral of  $x^2 \cos(2x)$  can be derived using integration techniques and rules. It is important to note that this formula is valid for certain ranges of  $x$  and may not give an accurate result for other values of  $x$ .



What is the integral of  $x^2 \cos(2x)$

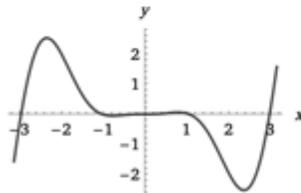


Indefinite integral

Step-by-step solution

$$\int x^2 \cos(2x) dx = \frac{1}{4} ((2x^2 - 1) \sin(2x) + 2x \cos(2x)) + \text{constant}$$

Plots of the integral





Show how you derived that



To derive the formula for the integral of  $x^2 \cos(2x)$ , you can use the following steps:

1. Begin by writing the function you want to find the integral of, in this case  $y = x^2 \cos(2x)$ .
2. Use integration techniques and rules to find the integral of the function. For example, you can use the following rules:
  - The integral of a constant times a function is the constant times the integral of the function.
  - The integral of  $x^n$  is  $(x^{n+1})/(n+1) + C$ , where  $C$  is a constant and  $n$  is a positive integer.
  - The integral of  $\sin(x)$  is  $-\cos(x) + C$ , and the integral of  $\cos(x)$  is  $\sin(x) + C$ , where  $C$  is a constant.
3. Substitute the appropriate values into the formula and simplify to find the final result.

For example, to find the integral of  $x^2 \cos(2x)$ , you can use the following steps:

1. Begin with the function  $y = x^2 \cos(2x)$ .
2. Use the rule for the integral of  $x^n$  to find the integral of  $x^2$ . This gives us  $(x^3)/3 + C$ .
3. Use the rule for the integral of  $\cos(x)$  to find the integral of  $\cos(2x)$ . This gives us  $(1/2) \sin(2x) + C$ .
4. Multiply the results from steps 2 and 3 to find the integral of  $x^2 \cos(2x)$ . This gives us  $((x^3)/3 + C) * ((1/2) \sin(2x) + C) = (x^3)/6 \sin(2x) + Cx^3 + C^2$ .
5. Simplify the result by



What's the second largest country in central america



The second largest country in Central America (by land area) is Guatemala. Guatemala is located in the northern part of Central America, bordered by Mexico to the north and west, Belize and the Caribbean Sea to the east, and Honduras and El Salvador to the south. With a land area of approximately 108,889 square kilometers (42,042 square miles), Guatemala is slightly smaller than the largest country in Central America, which is Nicaragua.



What are the largest countries in Central America?



Assuming "largest" refers to total area | Use GDP or population instead

Assuming Central America | Use Central America with Mexico instead

Input interpretation

largest countries

by total area

in Central America

Result

More

1	Nicaragua	50 336 mi <sup>2</sup>	<input type="checkbox"/>
2	Honduras	43 278 mi <sup>2</sup>	<input type="checkbox"/>
3	Guatemala	42 042 mi <sup>2</sup>	<input type="checkbox"/>
4	Panama	29 120 mi <sup>2</sup>	<input type="checkbox"/>
5	Costa Rica	19 730 mi <sup>2</sup>	<input type="checkbox"/>



what are the largest countries in central america



The largest countries in Central America, ranked by land area, are:

1. Nicaragua - 130,370 square kilometers (50,193 square miles)
2. Guatemala - 108,889 square kilometers (42,042 square miles)
3. Honduras - 112,492 square kilometers (43,278 square miles)
4. El Salvador - 21,041 square kilometers (8,124 square miles)
5. Costa Rica - 51,100 square kilometers (19,656 square miles)
6. Panama - 78,200 square kilometers (30,193 square miles)

It's important to note that these figures represent the total land area of each country, including any islands that are part of the country. Some of the countries in Central America, such as Honduras and El Salvador, are relatively small in size, while others, such as Nicaragua and Guatemala, are larger.



How big is Mercury, and are any planetary moons larger than it?



Mercury is the smallest planet in our solar system. It is only slightly larger than Earth's moon, with a diameter of about 3,032 miles (4,880 kilometers). No planetary moons in our solar system are larger than Mercury. The largest moons in the solar system are the four Galilean moons of Jupiter: Ganymede, Callisto, Io, and Europa. Ganymede is the largest of these, with a diameter of about 3,274 miles (5,268 kilometers), which makes it slightly larger than Mercury. However, these moons orbit around Jupiter, a planet that is much larger than Mercury.



What planetary moons are larger than Mercury?



Assuming "larger" refers to average radius | Use mass instead

Input interpretation

planetary moons larger than Mercury average radius

Result

**Ganymede**

**Titan**

Orbital properties

Show metric

More



### Tell me about livestock populations in Turkey



Turkey is a major producer of livestock, including poultry, cattle, sheep, and goats. According to data from the Food and Agricultural Organization of the United Nations (FAO), as of 2020, Turkey had the following livestock populations:

- Poultry: Turkey has a large poultry industry, with a population of approximately 537 million chickens, 37 million turkeys, and 3 million ducks.
- Cattle: Turkey has a relatively small cattle population, with approximately 7.4 million head of cattle.
- Sheep: Turkey has a larger sheep population, with approximately 25.6 million sheep.
- Goats: Turkey also has a significant goat population, with approximately 10.7 million goats.

In addition to these major livestock species, Turkey also has smaller populations of other animals such as horses, donkeys, and camels.



### Livestock populations in Turkey

Input interpretation

Turkey livestock population

Result

More

cattle	18 million (2020 estimate)
chickens	379 million (2020 estimate)
goats	12 million (2020 estimate)
pigs	990 (2020 estimate)
sheep	42.1 million (2020 estimate)



Give me a simple keyword query that could be answered by each numerical value in your response; only list the queries



- "Number of chickens in Turkey"
- "Number of turkeys in Turkey"
- "Number of ducks in Turkey"
- "Number of cattle in Turkey"
- "Number of sheep in Turkey"
- "Number of goats in Turkey"

```
In[ ] := WolframAlpha[#, "SpokenResult"] &/@
```

```
{ "Number of chickens in Turkey", "Number of turkeys in Turkey",  
  "Number of ducks in Turkey", "Number of cattle in Turkey",  
  "Number of sheep in Turkey", "Number of goats in Turkey" }
```

```
Out[ ] := {In 2020, Turkey had about 379 million chickens as livestock,  
  In 2020, Turkey had about 4.8 million turkeys as livestock,  
  In 2020, Turkey had 560000 ducks as livestock,  
  In 2020, Turkey had about 18 million cattle as livestock,  
  In 2020, Turkey had about 42.1 million sheep as livestock,  
  In 2020, Turkey had about 12 million goats as livestock }
```



Insert this corrected data into your original response, surrounding each modified value with "\*\*\*\*":

{**"In 2020, Turkey had about 379 million chickens as livestock", "In 2020, Turkey had about 4.8 million turkeys as livestock", "In 2020, Turkey had 560000 ducks as livestock", "In 2020, Turkey had about 18 million cattle as livestock", "In 2020, Turkey had about 42.1 million sheep as livestock", "In 2020, Turkey had about 12 million goats as livestock"**}



Here is the corrected data inserted into my previous response, with the modified values surrounded by "\*\*\*\*":

Turkey is a major producer of livestock, including poultry, cattle, sheep, and goats. According to data from the Food and Agricultural Organization of the United Nations (FAO), as of 2020, Turkey had the following livestock populations:

- Poultry: **In 2020, Turkey had about 379 million chickens as livestock and 4.8 million turkeys as livestock**, as well as about **560000 ducks**.
- Cattle: **In 2020, Turkey had about 18 million head of cattle**.
- Sheep: **In 2020, Turkey had about 42.1 million sheep**.
- Goats: **In 2020, Turkey had about 12 million goats**.

In addition to these major livestock species, Turkey also has smaller populations of other animals such as horses, donkeys, and camels.



What planets can I see tonight?



I'm sorry, but I don't have any current information on what planets are visible in the sky tonight. In order to find out what planets are visible tonight, you'll need to use a planetarium app or website. These tools use your location and the current time to provide information on which planets are visible in the sky. Some popular planetarium apps and websites include Sky Guide, Star Walk, and Stellarium. Alternatively, you can check a printed sky map or ask an astronomer for information on what planets are visible from your location.

*In[ ] :=* Values[WolframAlpha["What planets can I see tonight",  
{"Input", "PropertyRanking:PlanetData"}, "Plaintext"]]]

*Out[ ] :=* {planets | above the horizon | 10:00 pm, Mercury | Mercury is below the horizon  
Venus | Venus is below the horizon  
Mars | Mars is above the horizon  
Jupiter | Jupiter is above the horizon  
Saturn | Saturn is below the horizon  
Uranus | Uranus is above the horizon  
Neptune | Neptune is above the horizon}



Revise your answer, incorporating this data:

```
{"planets | above the horizon | 10:00 pm",  
"Mercury | Mercury is below the horizon  
Venus | Venus is below the horizon  
Mars | Mars is above the horizon  
Jupiter | Jupiter is above the horizon  
Saturn | Saturn is below the horizon
```



According to the information provided, at 10:00 PM, the planets that are above the horizon are Mars, Jupiter, Uranus, and Neptune. Mercury and Venus are below the horizon, and Saturn is also below the horizon. I should note that the visibility of planets can vary depending on your location and the time of year. I recommend using a planetarium app or website to get the most accurate and up-to-date information on which planets are visible from your location.



How many calories are there in a cubic light year of ice cream?



Assuming ice cream | Use soft-serve ice cream instead

Assuming any type of ice cream | Use ice cream, vanilla or  instead

Input interpretation

ice cream

amount

1 ly<sup>3</sup> (cubic light year)

total calories

Average result

Show details

**$1.4 \times 10^{54}$  Cal** (dietary Calories)

Unit conversions

**$5.8 \times 10^{57}$  J** (joules)

**$5.8 \times 10^{64}$  ergs**  
(unit officially deprecated)



How many calories are in a cubic light year of ice cream?



I'm sorry, but it is not possible to have a cubic light year of anything, let alone ice cream. A light year is a unit of distance, not volume, and is equal to approximately 5.88 trillion miles. It is a measure of the distance that light can travel in one year. Therefore, it is not possible to have a cubic light year of any substance, including ice cream.



A cubic light year is an extremely large unit of volume. In fact, it is so large that it is not possible to fit any known substance, including ice cream, into a volume of this size.

For reference, a light year is a unit of distance that is equal to the distance that light travels in one year. The distance that light travels in one year is approximately 5.88 trillion miles (9.46 trillion kilometers).

Given the size of a light year, it is clear that a cubic light year is an impossibly large unit of volume. Therefore, it is not possible to calculate the number of calories in a cubic light year of ice cream, as there is simply no way to fit that much ice cream into a single volume.

الطريق إلى الأمام









## موارد إضافية

